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By

WILLIAM J. MAYO

and

CHARLES H. MAYO

VOLUME II

ROYAL SOCIETY OF MEDICINE
27
MAR
1923

PHILADELPHIA AND LONDON
W. B. SAUNDERS COMPANY
1912

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INTESTINE (GENERAL)

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THE GREAT OMENTUM IN ABDOMINAL AND PELVIC SURGERY*

WILLIAM J. MAYO

In its practical relations to operations within the abdomen and pelvis the great omentum has not received the attention its importance deserves. Scarcely an incision is made into the abdominal cavity but this structure appears, yet surgical literature gives it only passing mention. McClellan best describes its anatomic peculiarities as being composed of two folds of peritoneum passing downward from the greater curvature of the stomach, varying in length, then duplicating itself back to the transverse colon. In these four folds of peritoneum is contained a quantity of fat, and to these folds is due the immense power to form adhesions which is the chief characteristic of the omentum, thus furnishing in a normal condition an efficient covering to the viscera from without, and in pathologic conditions from within, a competent barrier. Its blood-vessels freely anastomose with those of the peritoneum, giving enormous vitality, and herein it differs widely from the viscera nourished by a mesentery. Greig Smith is authority for the statement that the normal omentum is not demonstrable on physical examination, and eliminating as abnormal the not uncommon cases of large local deposit of fat in its folds, the assertion is true.

The omentum of itself is not often subject to disease, and in most instances is affected secondarily. Primary carcinoma is never found, as the omentum has no epithelial elements. Sarcoma is of rare occurrence, and at times cystic in character; the few sanguinolent cysts which have been collected and reported by Reamy, when not due to injury, were mostly of this nature. Papilloma of the omentum has been described, but Thornton believes that this condition, when found, is due to cell infection and hence a secondary condition. Hydatids have been frequently reported, but the most common growth is the lipoma. Secondary affections of the most diverse character are common, and are often due to the migration and grafting of neighboring tumors, *e. g.*, fibroids, and even the placenta in extra-uterine pregnancy.

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* Reprinted from "Trans. Minn. State Medical Society," 1893.

Orth discusses "chronic inflammation" at some length, and gives three varieties, but it is evident that these cases are purely tuberculous, and are chiefly interesting from a diagnostic standpoint, as they form a class of more or less well-marked tumors, often movable, and lying in a roll across the upper abdomen. I have met with two such examples.

Stabs and wounds of the abdomen are often complicated by injury and protrusion of the omentum; free bleeding is the usual result, and not infrequently causes hematoma in the omental folds. A collection of such cases was reported in the "Annals of Surgery," 1888.

The Omentum in Relation to Hernia.—The radical cure of hernia by modern methods has become a recognized procedure in any case, and particularly so when the epiploön forms an irreducible portion of its contents by reason of its very frequent adhesions to the sac, which prevent reduction and the proper application of a truss. Especially is this true of the hernias most common in women, femoral and umbilical, due perhaps to the fact that they are less careful to wear a truss, and in these varieties mechanical closure is at best unsatisfactory. Traction on the stomach by such adhesions is a not infrequent and often a serious cause of chronic gastric distress, and relieved only by liberation of the adherent epiplocele. I operated upon and gave relief in one marked case of this kind, a woman of fifty-five years with an irreducible femoral hernia, with few local symptoms at the seat of protrusion, but constant pain in the stomach. In post-operative ventral hernia these omental adhesions have often produced marked symptoms, and in numbers of instanes secondary celiotomy has been required to give relief. I have recently had such a case, and

I regret to say that I also performed the operation in which the ventral hernia resulted. In operating on a true umbilical hernia it should be borne in mind that for anatomic reasons the peritoneum may not be continued over the protrusion, and the sac may unexpectedly be opened, to the injury of its contents. The reduction of masses of omentum on even the ligated stumps may occasionally be a matter of difficulty, as in femoral hernia, where the nature of the tissues from which permanent closure must be obtained renders it undesirable to enlarge the opening, or adhesions inside the abdomen may prevent its return. Here Tait's method of reduction by pulling from the inside may be utilized. In the only case of this description I have met with I was compelled to make a secondary opening in the linea alba, and with my fingers inside liberate the adhesions. I was much impressed with the ease with which gentle traction from the interior reduced the ligated stumps after ineffectual efforts by direct pushing had failed. Internal hernias produced by the adherent omentum forming loops through which the bowel has been caught have been frequently reported, and should render us more painstaking in rearranging its folds after operation.

The Omentum in Relation to Internal Sepsis.—In a practical paper on "Omental Tumors Due to Adhesive Inflammation" Hadra says that its value in aiding the ready encapsulation of septic processes cannot be overestimated. Nature, in her abdominal covering, has left two weak points, inadequately protected, through which sepsis can readily penetrate into the peritoneal cavity, namely, the Fallopian tube and the appendix, and the tumor in the large majority of cases contains omentum as an important constituent of its covering. Should the original cause of trouble be absorbed, the resulting tumor gradually disappears, although it may render the diagnosis very difficult.

Gill Wylie reported several instances where a roll of adherent omentum behind the uterus induced celiotomy for a supposed tubal disease.

The diseased appendix found rolled up in the omentum and fastened to the anterior abdominal wall has not infrequently been observed in chronic cases, Bull reporting two and McBurney several. I operated in one chronic case where this condition was marked, and have seen a number of instances of this condition in acute abscesses. The facility with which nature limits the spread of a septic focus by the rapid adhesions of the omentum leads naturally to the application of grafts by the surgeon to protect weak points of intestinal suture or to damaged portions of bowel. To Senn is due the credit of the practical application of this method. He recommends the total removal of the graft, rather than its partial disconnection with the omentum, and after the end-to-end method of the approximation of the intestine by suture, completely surrounding the suture line by an omental graft two inches in width and holding in place by loose catgut sutures through the mesentery in the line of the vessels. Following Senn's lead many operators have utilized the omentum to cover defects in the peritoneum, or by proper application of suture to form a channel between an irreparable damage of a deep-seated viscus and the surface of the body. In the application of omental grafts the peritoneal surfaces to be brought into contact should be scarified, as otherwise the rigid asepsis which must be carried out may not cause sufficient irritation to produce adhesive inflammation.

Certain surgical principles guide us in handling the omentum, and the most important of these is in regard to hemorrhage. There is an especial tendency of its vessels to bleed, and a stump of omentum when apparently securely tied may retract sufficiently to allow oozing. Its vessels anastomose freely with the vessels of the peritoneum at points of adhesion, and bleeding occurs from both sides after separation. In hernia operations, as a rule, the adherent omentum is cut away, and Fowler advises to leave the ligature long and to draw it up for inspection. A pair of forceps attached to the stump will answer the purpose as well—the less ligatures are meddled with after tying, the better. Bull advises that the material for ligation be not too fine, that it may not cut. In umbilical and ventral hernia, where a knot from the center rather than from the margin of the omentum may be cut away, especial care must be taken to guard against hemorrhage.

When the omentum is adherent to a tumor, it should be completely separated and carefully examined at doubtful points. When forming part of the covering of the pus-tube, it is also best, as a rule, to complete its detachment before removing the pus-sac. In early operations for appendicitis this rule also applies, as the amount of pus is small and the operation is incomplete without removal of the appendix. But if the resulting abscess be very large, containing a pint or more of pus, and the incision be outside, over the walled-off area, great care should be taken not to disturb this protective barrier. The cavity should be carefully packed to the bottom, continuing this packing about the site of the appendix until complete separation of the damaged portion takes place—as a rule, fourteen to twenty-one days are required. The result will be final, but if a tube be inserted and the case left largely to nature, ready adhesions may encapsulate a damaged portion to do further mischief, and require subsequent operation.

Another important principle is that the omentum must be carefully arranged and left so as not to form adhesions to important organs or bands through which the intestine may slip. This especially applies to operations about the stomach.

Before closing I wish to call attention to two points of interest in the after-results of removal of portions of the omentum. In a late article Bull reports 8 cases of secondary inflammation of the omental stump occurring weeks or even several months after the operation, often forming a tumor and occasionally an abscess. As a rule, they end in recovery without much trouble. I have met with two well-marked instances: the first was after the removal of a considerable portion of omentum in a radical operation on a femoral hernia during the third week of a previously normal convalescence. This patient recovered in about a week.

The second case followed ligation and removal of a section of the omentum during an operation for dermoid cyst. This came on during the fourth week, and subsided in ten days, with perfect recovery. C. A. Wheaton first called attention to a peculiar cough and bronchitis which follow injury to the omentum, especially after ligation and removal of a portion. The frequency of this complication is altogether too common to be a mere coincidence.

GUNSHOT WOUND OF THE ABDOMEN—PERFORATION OF THE INTESTINES AND KIDNEY: OPERATION AND RECOVERY*

WILLIAM J. MAYO

E. B., male, aged twenty-one, was admitted to St. Mary's Hospital October 17, 1894, at 3.30 P. M., with the following history: At 7.30 A. M. of the same day he accidentally shot himself in the abdomen with a rifle at a distance of about one foot from the muzzle. At the time he was plowing in a field, the rifle pointed backward and lying along the plow. He fell to the ground, where he was seen by men working in the same field and assisted to the house. A physician was called, and finding the serious nature of the injury, applied an antiseptic dressing, placed him upon a cot-bed, and carried him to the train, to be transferred by rail 26 miles. He arrived at the hospital eight hours after the accident.

Examination.—Patient is conscious, very pale, and the body is covered with a cool perspiration. Pulse feeble, 146; temperature subnormal. He has no pain, some nausea and faintness. He states that one hour previous to the accident he had eaten a heavy meal. Urine was drawn and found bloody. Examination of the abdomen showed the entrance of the ball two inches to the left of the umbilicus, and on palpation a deep-seated swelling and tenderness of the muscles to the left of the spinal column are found.

Patient rapidly cleaned and stimulated, and moved to the operating-room at 4 P. M., where ether was administered.

A longitudinal incision was made into the abdomen, with its center at the site of entrance of the bullet. Upon opening the abdominal cavity blood in quantity mixed with partly digested food escaped. The omentum, which had been perforated, was pulled up, and the small intestines passed rapidly through the fingers, after marking the site of beginning the search with a suture carried through the mesentery. In the upper jejunum, about 14 inches from its beginning, at the fixed portion of the duodenum, a perforation was found and sutured with a Lembert stitch. Four inches higher up the gut a second large perforation was discovered in its posterior wall, and involving the mesenteric attachment, the mucous membrane being everted, and particles of the intestinal contents were found escaping. The intestine was angulated somewhat, and the wound sutured transversely with Czerny-Lembert sutures, after the principle of the pyloroplastic operation of Heineke-Mikulicz. This device gave increased size, rather than narrowing of the intestinal lumen. Several bleeding points in the mesentery were tied, and search for further perforations quickly made, without result. Examination of the left kidney revealed a ragged hole through its upper half. The patient was rolled upon his side, and a free incision made in the lumbar region to the kidney. The bullet, which had pierced the pleural cavity between the eleventh and twelfth ribs, was found buried in the muscles of the back. A piece of gauze was carried in its track for a drain. The kidney was pushed by hand in the abdomen well back into the lumbar incision, and a piece of gauze carried through the bullet wound of the kidney, to prevent abdominal extravasation of urine. The external incision was packed with gauze for free drainage.

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*Reprinted from "Northwestern Lancet," February 1, 1895.

The abdominal cavity was thoroughly flushed with hot water, and the anterior incision closed. Patient was put to bed in collapse, from which he rallied only after vigorous and persistent stimulation. The kidney drained freely for ten days and healed by granulation. Bowels acted without urging on the third day, the patient making a prompt and complete recovery.

REPORT OF A CASE OF CHRONIC INTUSSUSCEPTION CAUSED BY AN ADENOMA OF THE ILEUM, RELIEVED BY INTESTINAL RESECTION*

WILLIAM J. MAYO

Mrs. W. S., aged thirty-six years, German, was admitted to St. Mary's Hospital March 31, 1896, with the following history. She had been married fifteen years and had never been pregnant. For about ten years menstrual periods had been prolonged and the flow excessive in quantity, usually accompanied by pain. For five years she had had attacks of abdominal colic, which had increased in frequency until, for the past year, the pain had been almost continuous, requiring opiates for relief. For two years she had suffered from obstinate constipation, which could be relieved only by large doses of cathartics; the evacuations thus secured were thin, and at times bloody in character. This was accompanied by severe griping pains, which were referred to the region of the umbilicus.

Patient had had frequent attacks of vomiting; for the past six months had vomited several times a day, and had been constantly nauseated. She had been able to retain but little nourishment, and had suffered, in consequence, great loss in weight. A few days previous to her admission to the hospital the symptoms of obstruction had become pronounced. Her emaciation was marked; her temperature was normal; pulse, 110; abdomen distended and exceedingly painful; uterus somewhat enlarged. Urine contained 0.25 per cent. albumin, no casts, indican in abundance. During four days of observation the patient was almost constantly retching and vomiting, securing relief only by the use of opiates. After vigorous effort a few bloody discharges were secured from the bowels, but without relief to the distention.

Operation April 4, 1896. Under anesthesia the uterus was cureted. A considerable quantity of granulation tissue of simple adenomatous character was removed. Careful palpation disclosed a tumor in the abdomen, which could be brought into the pelvis; this was movable, about the size of an egg, and evidently had its origin in the upper abdomen. Continuous with its upper attachment was a soft mass, which could not be differentiated on account of the abdominal distention. This examination, with the history of colic, nausea, and vomiting, with alternating constipation and diarrhea, at once established a diagnosis of intussusception due to intestinal tumor.

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*Reprinted from "Annals of Surgery," December, 1896.

The abdomen was opened in the middle line, and an intussusception of the ileum in its upper portion, about 15 inches in length, was revealed. The apex of the invagination consisted of the tumor. After some difficulty the bowel was reduced, the most effective manipulation being to start a fold at the proximal side and, by progressive sliding, carry it toward the free end. There were no adhesions. Six inches of the gut, with the growth in its center, was excised, and the intestinal ends were joined with the Murphy button. The patient made a good recovery.

The pathologic examination: The tumor was adenomatous in character, with evidences of carcinomatous degeneration on the periphery. It was attached by a small pedicle, and at the seat of attachment the bowel was markedly inverted from the long-continued traction.

How long the invagination had existed in this case I am unable to determine, but believe that it was chronic rather than acute in character, although it is possible that it took place at the time of the acute symptoms, just before she was admitted to the hospital.

McBurney and Meyer, before the New York Surgical Society, January 22, 1896, have each reported a similar case.

In using the Murphy button in this case I attached a loop of silk thread to the holes in the distal side of the button, tying the ends about 8 inches away in a large bow-knot. This knot acts as a guide, and is sufficiently far from the resection wound to enable peristalsis to affect it, and this, with the traction exerted by the passage of intestinal contents, I believe greatly facilitates the downward movement of the button.

In only two out of four gastro-enterostomies, made before using this string guide, was the button passed; in one the button was found in the stomach at the postmortem months after the operation. Many such cases have been recorded. I have used this silk loop in two gastro-enterostomies since, the buttons being passed respectively in seven and eleven days.

INTESTINE (TUBERCULOSIS)

FORMS OF SURGICAL TUBERCULOSIS NOT COMMONLY RECOGNIZED*

WILLIAM J. MAYO

The importance of surgical tuberculosis is too evident to require any emphasis on my part. Affecting the bones, joints, glands, etc., it is as generally recognized by the practitioner as when it invades the brain, lungs, or intestines. As a pathologic process in the skin and mucous membrane, under the old term of "lupus," we have learned to know its changing face.

Among the "infective granulomata" tuberculosis and syphilis occupy preëminent positions and have many features of resemblance; particularly is this true when affecting the skin and mucous membranes, and at times this likeness is so great as to render specific treatment the only means of identification.

As a pathologic condition, tuberculosis must be looked at from two sides: first, as an uncomplicated process, in which form it seldom destroys directly, except in the brain, where the unyielding nature of the bony envelops allows the effusion produced by the meningeal irritation to destroy life; such injurious effects in the pleural, peritoneal, and joint cavities being prevented by the elasticity of their coverings. In uncomplicated cases we see the tubercle bacillus, an obligate germ, a parasite, compelled to live upon its host, and not always to the destruction of the latter, as if it always destroyed its bearer, it would itself perish from lack of sustenance, illustrating a great law of nature that a species must be preserved.

Tuberculosis, however, is not an unmixed evil, weeding out unhealthy and weakly hosts, to the betterment of future generations —a survival of the fittest. Mix with facultative or pus-producing germs, and how quickly the condition changes! the so-called "cold abscess," or local collection of tuberculous débris, becomes infected with a germ not confined to any particular soil for nutrition, hence of greater destructive powers. The slow process becomes an active one; the tissues, weakened by tuberculous infiltration, furnish a favorable field for a secondary infection. Septic symptoms appear, and unless the process be favorably situated to permit of free drainage or small in extent, nature unaided cannot cope with its invaders, and either succumbs, or recovery ensues only after months or years of suffering, and with permanent crippling and loss of tissue. Therefore it may be said that secondary infection of a small tuberculous focus may destroy and discharge it from the human economy, preventing further tuberculous extension. But it is a dangerous weapon, and the large majority of tuberculous patients are directly destroyed by septicemia. It should not be forgotten that while, as a rule, the tuberculous infection is first and the septic or other infection second, it is not necessarily so. A syphilitic process may be prevented from healing by a secondary tuberculous inoculation, and not infrequently a septic process is afterward poisoned by tuberculous bacilli; *e. g.*, a wound is healing rapidly; suddenly the granulations become flabby and pale, the healing process stops or retrogrades, and a mixed infection must be fought. Again the middle ear suppurates and is secondarily infected with tuberculosis, and the ear discharges for years, or a fissure of the nipple is inoculated and tuberculosis of part of the breast and axillary glands follows. I have recorded two such cases.

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*Read before the Southern Minnesota Medical Association, July 28, 1892. Reprinted from "Northwestern Lancet," January 1, 1893.

It has been curious to note, in our own limited observation, how frequently one family suffers from pulmonary tuberculosis among a number of its members, with but few marks of surgical tuberculosis independent of the lung lesions, considering, of course, the local lesions in the larynx, throat, and mouth, as well as anal and rectal fistulas, etc., occurring in these cases, to be due to secondary inoculation from the passage of tuberculous sputa—an inherited respiratory weakness. In other families, particularly among the Scandinavians, surgical tuberculosis presents itself in various forms among several members, and the disease of the lungs, if it occurs, is a late symptom.

Popularization of correct views on the pathology of surgical tuberculosis in English-speaking countries has been slow, and due largely to such men as Bland-Sutton and Treves in England, Roswell Park, Gerster, and Senn in the United States. During the many years of "chronic inflammation" with us the Germans knew and taught its essential pathology, and scrofula was a thing of the past.

Tuberculosis of the tongue, almost from its inception, represents a form of mixed infection, and the early ulceration causes a superficial resemblance to cancer; no doubt many cases of supposed cancer of the tongue reported cured by an unnecessarily severe and mutilating operation have been instances of this affection; of 5 cases I have seen, 3 were sent to me for operation with a diagnosis of epithelioma.

Subacute pleurisy with effusion has long been known only too frequently to be followed in after years by phthisis, and is a good example of pure tuberculous infection, the serous surfaces pouring out abundant fluid, in the uncomplicated cases to be gradually absorbed, the ready adhesions of the serous surfaces encapsulating the pathologic products. Absorption of these adhesions may in time free these foci and respiratory movements aid in disseminating them, resulting in phthisis; or empyema, localized or general, may complicate. Dry forms of subacute tuberculous pleurisy are less liable to these complications.

Tuberculous peritonitis follows much the same course as when the joints or pleura are involved; dry hyperplastic forms cause many of the adhesive bands, which are discovered only when an intestine becomes imprisoned by one, or the adhesions may be so generalized as to mat the intestines closely together with fibroplastic material. Ascites, general or local, may complicate and resemble tumors, etc. Infection frequently takes place in women through the Fallopian tube, abdominal respiration and intestinal peristalsis aiding in the dissemination.

Dry adhesive tuberculosis of the joints is not generally recognized, and cripples many a joint. Atrophy of the muscles is a marked symptom; especially is this true of the shoulder-joint; the free movement of the scapula on the body simulates a movement in the joint, and the marked muscular atrophy leads to a diagnosis of paralysis, and electricity is applied to the deltoid region.

Fascia tuberculosis is not uncommon, and when affecting the large fascia and intramuscular septa of the thigh, causes a "cold abscess" of enormous size. In the one case that was under my care I could not then understand why careful examination by incisions failed to reveal any other cause for an abscess extending from the knee to the trochanter, which resulted fatally through mixed infection.

Tuberculosis of the tendons and their sheaths is one of the most troublesome forms of local tuberculosis. It may occur independent of joint lesions or in connection with them. The wrist is most commonly affected. Rice-like bodies found floating in the fluid are detached papillary tuberculous masses. Ganglia are frequently of the same nature, and in such cases consist of more or less encapsulated tuberculous foci in connection with the tendon-sheaths.

LOCALIZED TUBERCULOSIS OF THE INTESTINE: A REPORT OF SEVEN CASES OPERATED UPON*

WILLIAM J. MAYO

Tuberculosis within the abdomen is of frequent occurrence, and clinical experience in abdominal surgery demonstrates that the disease as a primary infection is not uncommon, or, if not primary in all cases, the abdomen is, at least, the only locality involved in which it can be recognized.

The prevalence of tuberculosis of the bowel in children is shown by the statistics of Sims Woodhead. In 127 autopsies on children dying of tuberculosis the mesenteric glands were found to be involved in 100, and it is to be presumed that the intestinal was the primary lesion.

In the New York Pathologic Society, November, 1898, R. G. Freeman reported a case of primary tuberculosis of the colon in a child, and discussed the moot point as to its frequency.

In adults the bowel infection is usually secondary. Out of 1000 autopsies held on the victims of tuberculosis in the Pathologic Institute of Munich, 566 showed secondary involvement of the intestines, and in only one case was the disease primary. Hilton Fagge says that in twenty-five years at Guy's Hospital only one case of primary tuberculous ulcer of the intestine was found. He, however, notes some intestinal strictures which may have had such origin.

The frequency of primary tuberculosis of the intestine in children is believed by Osler to be due to milk infection; it has been shown by Ernst that the milk may be actively infected without disease of the udder. Adult foods, such as cooked meats, etc., are less dangerous as a primary source of disease.

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*Read before the Minnesota Academy of Medicine, February 1, 1899. Reprinted from the "New York Medical Journal," August 19, 1899.

The prevalence of pulmonary tuberculosis in the adult, and the frequency with which sputum is swallowed, account for the secondary nature of the intestinal deposits.

H. A. Tomlinson, superintendent of the St. Peter, Minnesota, State Hospital for the Insane, has had an exceptionally large experience in the pathologic study of tuberculosis among the inmates of that institution, and, as the mentally deficient usually swallow the sputum, he has found secondary intestinal infection to be the rule.

Osler mentions the possibility of secondary bowel infection through extension from the peritoneum.

In a most exhaustive paper on Intestinal Tuberculosis published in the "Journal of the American Medical Association" in May and June, 1898, Senn says: "That the disease may occur as a primary infection can no longer be doubted. The results of an enormous clinical experience and thousands of necropsies furnish a substantial verification of this fact."

It is hard to reconcile the divergent opinions of men of large experience as to the relative frequency of primary intestinal tuberculosis. With a view to ascertaining the relative proportion from the standpoint of the operating-room, rather than the deadhouse, I have examined the records and printed reports of St. Mary's Hospital for the past six years. I find the total number of operations classed as abdominal within this period to be 1003, and of this number 64 were performed for tuberculosis, divided as follows: Tuberculous peritonitis, 30; encapsulated tuberculous collections of fluid forming an abdominal tumor, 3; ovaries and tubes, 11; appendix, 7; kidneys, 7; intestinal wall, 6. The patients treated in this hospital are drawn almost entirely from an agricultural community.

The reports previous to 1893 contain but few cases in which the diagnosis was made, although I have reason to believe it was often met with, but unrecognized. This would give tuberculosis a place in abdominal surgery of about 6.5 per cent. The 6 cases in which the intestinal wall was involved and in which the infection appeared to be primary would amount to 0.6 per cent. of the total number. These few cases, with the addition of one case operated on at St. Mary's Hospital in 1891, form the basis of this paper.

Experiments have shown that the tubercle bacillus is not killed in the gastro-intestinal juices, and that it is able to penetrate the intact mucous membrane. Peyer's glands and the lymph-follicles are the common seat of infection, but the process soon involves the submucous tissue, and then ulcerates through the agency of a mixed infection. In primary tuberculosis the greater part of the involved tissue may slough, and by cicatrization a corresponding narrowing of the intestinal lumen takes place.

The consequent interference with the progress of the intestinal contents may be the first symptoms of the disease. This form of obstruction in an acute stage led to operation in three of the reported cases.

In the causation of the symptoms the effects of secondary pyogenic infection is of the utmost importance. The peritoneum becomes thickened and board like over the ulcerated area, and to this point the neighboring coils of bowels may become attached, leading to kinking and partial obstruction, or form multiple intestinal fistulas.

A complete ulceration through all the coats of the intestinal wall protected by adhesions may allow a localized tuberculous pocket, giving the appearance of an abscess, as in Case V.

Rokitansky long ago pointed out the tendency of intestinal tuberculosis to follow along the blood-vessels and produce a circular deposit, as carcinoma is wont to do. The healing process, when established in such ulcers, leaves a circular stricture. In secondary tuberculosis there is but little tendency to cicatrization, and the extent of disease is usually larger.

Primary tuberculosis in children is less apt to ulcerate deeply, the rule being early involvement of the mesenteric glands, which in turn act as a distributing depot to the general system, through either the lymphatic channels or the blood-vessels.

The experience of nearly all observers has been that in adults there is a distinct tendency for the primary disease to remain local, the prognosis, therefore, being far more favorable than in children. Senn points out the fact that in many cases supposed to be primary there are other infected localities which may not be recognized.

The most common seat of primary tuberculous disease is in the ileocecal coil. The sigmoid and the lower ileum are also often affected, although any part of the intestinal tract may be involved.

Senn describes two forms of disease: one fibrous, with marked hypertrophy, resembling carcinoma, and an ulcerative variety, more apt to cause stricture. The two phases of disease are often present in the same case.

According to Hofmeister, multiple strictures are found only in the ileum. The appendix is often the starting-point of the infection in the cecum.

The diagnosis of secondary tuberculous infection of the intestines is usually easy, but this cannot be said of the primary variety. In only 2 out of the 7 cases herein reported was the diagnosis made. In Case IV the appearance was that of cancer, although tuberculosis was thought of.

In a general way it may be said that the ages of the patients range between fifteen and forty. In our series of cases the youngest was eighteen and the oldest thirty-seven. A tuberculous family history was present in only two, and was not marked in either case. The general appearance in the cases with obstruction was good up to the time of the sudden bowel stoppage, and in none of the cases reported has there been the cachexia of a cancerous affection of the same duration. In the three cases having the largest extent of ulceration there has been some evening rise in temperature.

In the majority of cases alternating constipation and diarrhea have been observed, and in the strictured individuals serious symptoms of obstipation have appeared several times before the attack of obstruction rendered relief imperative. In only one case was diarrhea marked, and in this one the cecum and ascending colon were extensively involved. Diarrhea would argue in favor of larger extent of ulcerated surface, and is common in the secondary forms of the disease.

The constant symptoms in all cases have been colic and colicky pains, and in 5 out of the 7 cases urinary irritation was an annoying feature.

Fixation of the uterus, with seeming enlargement of the ovaries and tubes, led to operation in two cases. In each instance a peculiar change in the apparent size and consistence of the lateral masses was manifest on different days, probably due to the amount of retention of bowel contents above the stricture, and perhaps, also, as H. A. Kelly has pointed out, to the changing amount of fluids in the coincident pelvic disease. Rigidity of the abdominal muscles, preventing accurate palpation, was also present in these two cases, and in the experience of the writer this peculiarity, with an undue sensitiveness, has been common in tuberculosis of the ovaries and tubes. A well-marked tumor in the cecal region was present in three cases, and this enlargement was nodular and apparently contained gas.

Examination of the stools for tubercle bacilli should be practised, although the limited extent of disease does not lead to frequent success. Sawyer says that the mucous membrane just inside the sphincters is most likely to contain the germs. Rectal discharges of pus and blood should lead to a careful examination of the rectum and sigmoid by Kelly's method. I have under observation at this time a patient with marked tuberculous ulceration of the sigmoid detected in this manner.

Strictures resulting from the healing of tuberculous ulcers must be distinguished from the congenital and traumatic varieties, and from those following the reduction of inflamed hernias.

Only one case in which a stricture followed typhoid ulceration could be found by Treves. Syphilitic stricture, according to Senn, is always fibrous and never ulcerative. Of the various forms, the carcinomatous stricture will give the greatest difficulty in diagnosis, even when the parts are exposed. In both, enlarged glands are found. The tuberculous glands are hard and cheesy. The carcinomatous area will have dilated and tortuous blood-vessels underneath the peritoneum; it also shows no scars of cicatrization, and is not so densely adherent in the early stages as the tuberculous variety. Maylard speaks of edema and inflammation in the vicinity of the umbilicus as an indication of ulcerative tuberculosis, and Tillmanns remarks on the frequency with which chronic indurations of the abdominal wall, with slow formation of abscess, are followed by fistulas communicating with the bowel. In Senn's monograph, previously referred to, will be found a differential diagnosis worthy of the most careful study.

The indications for treatment may be divided into two classes: First, for the tuberculous process itself, and, second, for the relief of mechanical interference with intestinal action, the result of cicatrization. The management of localized intestinal tuberculosis without obstruction is certainly surgical; but to what extent should the operation be carried? Clinical experience has demonstrated that nearly all forms of primary tuberculosis in the abdomen may be cured by simple incision of the peritoneum, and many cases of tuberculous intestinal disease relieved in this way have been placed on record.

It is possible that the "malignant tumors" in the abdomen cured by laparotomy, recorded by Tait and others, may have been tuberculous.

Removal of the cecum and ileocecal coil or ascending colon has been practised with good results, and many cases are now recorded by Senn, Pilcher, Ochsner, Körte, Sachs, and others. In most cases extensive regional glandular infection will be found. The appendix is frequently the starting-point of the disease, and has often been removed, leaving the tuberculous cecum and caseating glands untouched, and yet apparent cure has resulted. Each case must be judged on its own merits.

Strictures following upon the healing process and causing mechanical obstruction of the bowels belong to the radical operations of necessity.

Intestinal resection or extirpation of the ileocecal coil is most frequently demanded. Occasionally the extent of the involved area or the debilitated condition of the patient may render intestinal anastomosis above and below the obstruction the safer procedure. This is particularly the case in extensive disease of the ileocecal coil, rendering ileocolostomy the operation of choice. Senn notes in this connection that even a short length of remaining large bowel is sufficient to dry the stool, and this was our experience in Case IV; also in a second case of ileocolostomy for the relief of ileovaginal anus, reported in the "Annals of Surgery," November, 1897.

In other cases the adhesions of coils of bowel to the peritoneal plaque covering an intestinal ulcer may lead to angulation. In two of our cases this condition alone seemed to account for the obstruction. On separating these points of union we have noticed that the adhesions were thick and more vascular than in the ordinary inflammatory disease as encountered in the pelvis, and there were no planes of cleavage discoverable. There was also a structural change, involving all the coats of the bowel at one limited point of contact. On separation the affected parts had an eroded granular appearance, looking like a lupus of the skin after removing an adherent scab. All these places should be either cleanly excised or turned into the bowel and carefully sutured in this position, as a point in the center usually communicates with the intestinal lumen. If the suture is secure and there is no need of gauze protection against possible leakage, silk should be used for that purpose, but if it seems desirable to quarantine the suspicious area, catgut should be employed as a suture material. In our experience the tract established by the gauze is almost certain to become infected with pyogenic organisms, and silk at the bottom of a tuberculous sinus means chronic suppuration, and a fistula having a communication with the bowel will ultimately form.

Drainage of primary wound secretion in the abdomen is seldom necessary in chronic disease, and usually does not take place even if desired, but occasionally a suspicious point should be isolated and connected with the surface by the formation of adhesions around a piece of gauze, to protect against infection or leakage.

Such treatment leaves much to be desired. The post-operative suppuration in Cases IV and V was of a peculiar oily character, very fetid, with, eventually, a minute fecal fistula; both of these patients had a considerable elevation of temperature while the discharge lasted. If catgut is used, the fistula will heal spontaneously in from three to twelve weeks, according to its extent —at least this has been our experience.

In Case III there was no protection. While no postmortem was secured in this case, I believe there was a leakage at the suture line.

Intractable tuberculous ulceration of the sigmoid, either with or without stricture, has been successfully treated by a temporary or permanent inguinal colostomy.

In looking back over our experience in this class of cases we note their wonderful ability to withstand operative interference. The chronic nature of the disease seems to furnish a partial immunity to injury, and operations can be fearlessly undertaken which would not be justifiable in acute infections or cancer. The operations performed in several of these cases were very incomplete and unsatisfactory, yet apparent cure resulted.

Case I.—*Localized Tuberculosis of Ileum; Separation of Adherent Intestinal Coils; Secondary Operation for Fecal Fistula; Recovery.*—Miss M. K., single, aged twenty-three years; American. Admitted to St. Mary's Hospital July 8, 1891, with a history of abdominal swelling and pain of a colicky character, which had begun rather suddenly a year previous. Constipation alternating with diarrhea and occasional attacks of vomiting were prominent symptoms. Menstruation prolonged and excessive; bladder irritable. There had been a progressive loss of weight and strength. Family history negative. Examination of heart, lungs, and urine negative; temperature, 100° F.; pulse, 100; abdomen tympanitic; muscles rigid and in places board-like; uterus fixed by masses of a rather peculiar character in the small pelvis. This local condition on several examinations on different days never appeared twice just alike.

A diagnosis of pelvic peritonitis, probably of tubal origin, was made, and on July 12th the abdomen was opened in the midline; the peritoneum was very thick, and the omentum generally adherent; there was no fluid, and the intestines in the small pelvis were more or less covered with adhesions, and had formed the mass felt on vaginal examination.

In the vicinity of the umbilicus the small bowels were matted together, forming a partial obstruction. On separating these adhesions a coil of ileum was found to have a large, thick cicatrix on its free surface, not of itself obstructive, but to which the neighboring intestinal coils had become adherent. The adjacent peritoneum was studded with tubercles. A small drain was inserted and the abdomen closed.

On the sixth day the abdominal wound opened and began discharging the contents of the upper small bowel, the escape of food taking place within a few minutes of its ingestion. The prostration became extreme. Three weeks after the first operation a finger introduced into the fistula showed a sharp spur in the bowel at the angle of adhesion; this spur was caught with a pair of forceps, one jaw in the afferent and one in the efferent portion of the bowel, and clamped (method of Dupuytren). Five days later the forceps cut its way through, and after a trying time during the next three months the wound healed. The patient recovered completely and now, seven and a half years later, is in excellent health.

Case II.—*Tuberculous Ulceration of Ileum Causing Obstruction; Intestinal Resection; Recovery.*—C. K., a man aged eighteen years; German. Admitted to St. Mary's Hospital October 8, 1896. Five months previously he had been seized suddenly with vomiting and pain in the hypogastrium. The abdomen became bloated, and bowel movements could not be secured for a number of days. There had been some urinary distress. After three weeks he improved and was able to be about, but the colic and distress were almost constant; movements from the bowels were exceedingly hard to obtain, and gave only temporary relief. There was a gradual loss of 70 pounds in weight; nausea was constant, and vomiting of daily occurrence. Family history good.

Examination.—Emaciation extreme; pulse, 130; temperature slightly subnormal. Urine contained 0.1 per cent. of albumin, and indican in abundance. Heart and lungs normal. Abdomen greatly distended, and the dilated coils of intestines could be plainly seen during peristalsis. No tumor could be discovered.

Diagnosis.—Chronic obstruction of the small bowel.

Operation October 9th. On opening the abdomen coils of the greatly distended small bowel protruded and were allowed to remain outside under hot towels in sufficient quantity to expose the seat of trouble, which consisted of an adherent mass of ileum near the ileocecal juncture. In attempting to separate the adhesion and relieve the obstruction the distended bowel was opened and at once emptied and sutured. A large ulcerated and partially cicatrized surface was finally disclosed in the ileum, and this communicated with two coils of bowel by fistulous openings. In attempting to liberate this portion of bowel it was torn completely through.

Four inches of the ileum, including the diseased area, were excised, and an end-to-end suture anastomosis effected. This was rendered very laborious on account of the inability to bring the parts to the surface, and the great disparity in size and thickness of the muscular coats of the two parts of the bowel united, the proximal portion being greatly dilated and much thickened.

The fistulous openings in the adherent coils were excised, and the defects closed by purse-string sutures. A gauze drain was inserted. On removing the drain on the fifth day a small fecal fistula developed, which spontaneously closed in fourteen days.

The patient was discharged November 14th in good condition. Now, two years and a half after the operation, he is in perfect health and has gained 100 pounds in weight. The pathologic specimen showed the characteristics of tuberculous ulceration.

Case III.—*Localized Tuberculosis of Sigmoid and Tubo-ovarian Disease; Secondary Involvement of Ileum and Bladder; Operation; Death.*—Mrs. F. H., aged thirty-six years; American; married; no children. Admitted to St. Mary's Hospital April 29, 1897, with a history of pelvic pain extending over a period of six years. Bowels obstinately constipated. Bladder irritable. Menstruation excessive and lasting from ten to fourteen days. Digestion poor; colic frequent. Family history of tuberculosis and cancer.

Physical Examination.—Patient fairly well nourished. Heart and lungs normal. Urine contains a few pus-corpuscles. Pulse, 96; temperature, 98.4° F. Abdominal muscles rigid. Uterus retroverted and adherent. An indefinite swelling can be plainly felt on each side of the uterus.

Diagnosis.—Inflammatory disease of tubes and ovaries.

Operation on May 1, 1897. A coil of lower ileum and the bladder adherent to the sigmoid. There were no planes of cleavage, such as are usually found in inflammatory disease. The tissues were friable and looked granular when separated. Both the bladder and ileum were opened during separation, and the injuries were at once carefully sutured. An irregular ulceration of sigmoid, partially cicatrized, was drawn to the surface, turned in, and the peritoneum sutured over. The ovaries and tubes were bound down by dense adhesions, and both tubes contained straw-colored fluid. The appendages were removed, and the uterus suspended anteriorly. The abdomen was closed without drainage. Death occurred on the fifth day from septic peritonitis. There was no postmortem.

Case IV.—*Tuberculosis of Cecum and Appendix; Operation; Improvement; Readmitted Seven Months Later with Obstruction of the Bowels; Ileocolostomy; Recovery.*—Mrs. H. O., aged thirty-seven years; American. Married and the mother of nine children, the youngest of whom is three years old. She has not been well since the birth of the last child; has been weak and tired, and hardly able to do her work.

For the past six months has had a constant pain in the right side, and has suffered from cramps in the bowels; constipation alternating with diarrhea and occasional discharge of a slimy character have been observed. There has been some irritation of the bladder, quite annoying at times. Menstruation normal. Patient also states that there is an enlargement in the right side, which, she thinks, has been present for three years, and is increasing in size. Family history good.

Physical Examination.—The patient is of an anemic appearance. Temperature, 99.5° F.; pulse, 100. No evidence of disease in the lungs. Heart normal. Urine contains pus-corpuscles. An indefinite thickening in the region of the right broad ligament can be felt through the vagina and rectum. In the right side of the abdomen is a well-marked enlargement occupying the position of the cecum and extending upward to the lower free ribs. It is irregular in outline, and appears to contain gas.

Diagnosis.—Probable carcinoma of the cecum.

Operation on April 28, 1898. A free incision was made directly over the enlargement, which was found to be the cecum. It was adherent, and the surface was marked with board-like scars. The appendix was thoroughly involved, and lay in the pocket under the ileocecal juncture. The right ovary and tube were also involved in the caseating mass. Lymphatic glands in the neighborhood were enlarged and cheesy. A portion of the cecum was excised with the appendix and right ovary and tube. A retrocecal tuberculous pocket was cureted and iodoformized, and an iodoform gauze drain was inserted. On its removal a small fecal fistula appeared. For six weeks an oily, offensive discharge continued, and a continuous temperature elevation was noted. Patient was discharged with a cicatrized wound June 8th.

In September the patient was reëxamined and appeared to be in excellent health, having gained 33 pounds in weight, but she complained of some stomach disturbance, with attacks of vomiting and obstinate constipation, which have appeared within two weeks.

November 7th: The patient was readmitted to the hospital suffering from obstruction of the bowels, which had lasted nearly a week; vomiting was frequent, and the abdomen was markedly tympanitic. It appeared that the symptoms of obstruction had been steadily increasing since the examination in September, and were relieved with more and more difficulty until the trouble had culminated in the present attack. It was also noted that the bladder had become involved, and shortly before an abscess had opened into this viscus and still discharged by this route, to her great distress.

Operation by C. H. Mayo. The ileocecal coil was involved in a tuberculous process, producing the obstruction. An indurated area connected this with the bladder, and this was not disturbed. The ileum was divided 8 inches above the ileocecal valve, at a point well above the disease, and the distal portion was emptied and the cut end turned in and sutured. The proximal end of the ileum was anastomosed with the transverse colon by a Murphy button.

The contents of the enormously distended small bowel were milked through the button into the colon. The abdomen was closed without drainage. The bowels acted freely within a few hours, and the patient convalesced rapidly. The discharge of pus and tuberculous débris through the bladder immediately lessened, and in four weeks entirely disappeared. The button came away in twelve days. Patient was discharged December 15th in good condition. The ultimate result would seem to be uncertain.

Case V.—*Tuberculosis of Cecum and Ascending Colon; Formation of Tuberculous Abscess; Operation; Improvement.*—Mrs. F. A. G., aged thirty-seven years; American. Admitted to St. Mary's Hospital September 27, 1898. Has been married two years and is the mother of one child, two months old. She has been unable to nurse her child. Menses have not reappeared as yet. She states that for two or three years she has been annoyed by a pain in her right side, which was aggravated by the pregnancy.

After confinement her physician discovered a tumor in the right side of the abdomen, which has been exceedingly tender. Bowels irregular; of late, a tendency to diarrhea. Family history of tuberculosis.

Physical Examination.—A spare woman of anemic appearance. Heart and lungs normal. Urine negative. Temperature, 101° F.; pulse, 110; generative organs normal. There is an oblong mass in the right side, occupying the usual situation of the cecum and ascending colon, which feels hard and nodular; it evidently contains gas. In the loin there is a tendency to induration, which may be due to a deep-seated abscess. Leukocytosis not present.

Diagnosis.—Tuberculosis of cecum with secondary abscess.

Operation on October 1, 1898. A lateral incision was made, with its center over the inflamed area. On opening the abdomen the walls of the cecum and ascending colon were found to be enormously thickened, and in places ulcerated patches, well roofed in by thick plastic deposit, could be made out.

The deep glands behind were caseated. The inflammatory deposit was a typical tuberculous abscess, adherent to the abdominal wall, and communicating with the colon, into which it evidently discharged. The colon was opened, and extensive tuberculous ulceration could be seen. So far as could be demonstrated, the disease was confined to this region. The abscess cavity was iodoformized and packed with gauze, and the opening in the bowel repaired and covered with an omental graft. A slight fecal fistula followed the removal of the gauze drain on the fourth day, and for six weeks a fetid, oily discharge continued.

During this time the patient had constant high temperature. Discharged from the hospital November 8th, greatly improved. Now, four months after the operation, the mass is very much less prominent, and there is a gain of 30 pounds in weight, and a corresponding improvement in general health can be noted.

CASE VI.—*Tuberculosis of Sigmoid, Causing Stricture; Operation for Obstruction of the Bowels; Recovery.*—Mrs. J. A. W., aged thirty-four years. Admitted to St. Mary's Hospital June 27, 1898. Patient has been married two years; no children. She has had three well-marked attacks of appendicitis, and at this time is just recovering from the fourth attack. Her physician states that the character of the trouble appears to have changed, the earlier attacks being typical, while the illness from which she is now convalescing has been in the nature of an obstruction of the bowels. Menses regular; bowels generally constipated. Family history good.

Physical Examination.—Patient of delicate physique. Temperature and pulse normal. No evidences of disease of lungs, heart, kidney, or generative organs. Palpation of the appendix elicited some complaints of pain.

A diagnosis of relapsing appendicitis was made on the history. On June 26th the diseased organ was removed through a short lateral incision. The appendix was adherent and contained several strictures. There were no signs of recent inflammation. Discharged July 15th.

Within one week of her arrival home she experienced another attack precisely like the last one. The obstruction was never fully relieved from that time. The vomiting, intense pain, and abdominal distention yielded only after great effort to act upon the bowels, and the relief afforded was very temporary. It was noted in this later history that only small enemata could be retained, although nothing could be felt by digital examination through the rectum.

Patient readmitted October 15th in bad condition. Pulse rapid and feeble. Abdomen greatly distended with gas, peristalsis being markedly visible. This was especially noticeable in the left iliac region. Emaciation extreme. No action of the bowels had taken place for two weeks; once flatus had escaped. The vomiting was almost constant, and the pain could be checked only by the subcutaneous exhibition of morphin.

Operation was performed as soon as the patient could be prepared. A median incision revealed a tangled mass of bowel in the pelvis. This proved to be two coils of ileum adherent to a point on the sigmoid within two inches of the beginning of the rectum. The separation was difficult, and resulted in opening each loop of the small bowel. The adhesions were not general, but rather a dense union over a small area, being friable and granular. The surfaces containing the defects in the intestinal wall were turned into the lumen of the bowel by sutures. The disease in the sigmoid seemed completely to surround the gut, and it could not be brought to the surface. An assistant placed two fingers in the rectum, and I was able to depress the stricture sufficiently to invaginate it into the rectum, while my assistant forced his fingers through and dilated it thoroughly. In doing this, the friable tissues ruptured. This was repaired as well as time would allow by transverse suturing, which enlarged the opening, and the result was far from being satisfactory. The pelvic peritoneum was studded with tubercles.

A large iodoform gauze tampon was placed to protect against the expected leakage. The sigmoid was brought to the surface and fastened to the upper end of the wound above the drainage, and marked with black silk guides, and finally the ileum proximal to the sutured parts was fastened along the side of the sigmoid to the peritoneal edge of the wound, and also marked with silk guides, to be used should it be necessary later to open the bowel to relieve the obstruction.

Patient in collapse, from which she slowly recovered. The obstruction was not relieved, and the condition appeared to be hopeless. In forty-eight hours the sigmoid was opened, but without relief; twelve hours later, although the patient was barely alive, the small bowel was opened and some gas and liquid contents began to escape.

From this time on the discharge of small-bowel contents became profuse, and after a prolonged struggle the patient rallied. The fistulous openings healed spontaneously. The stricture below can now be reached by the fingers in the rectum, and is stretched digitally twice a week. The patient is gaining rapidly in weight and strength. Discharged January 8, 1899.

CASE VII.—*Tuberculosis of the Cecum and Appendix; Appendectomy; Improvement.*—Miss A. E. B., German, aged eighteen years. Admitted to St. Mary's Hospital November 28, 1898. The following history was obtained: Attacks of abdominal pain began about eight months ago. These spells have grown more severe and are accompanied by diarrhea. From the first the looseness of the bowels has been marked, and the discharges are slimy and offensive in character. There has been some urinary irritation at times. Menses stopped five months ago. The weakness has been progressive, and she has lost 35 pounds in weight. There has been a more or less constant soreness in the right side. Family history good.

Examination.—A slender, anemic girl, with a pulse of 116 and temperature 101° F. Lungs, heart, kidneys, and generative organs show no evidences of disease. Abdomen tympanitic, and considerable gurgling can be developed in the colon. The region of the cecum is board-like, and the lower right rectus muscle is fixed.

An indefinite enlargement at this point can be mapped out, which contains air and fluid. Examination of stools for bacilli of tuberculosis negative. Diagnosis, tuberculosis of cecum and ascending colon.

Operation on November 30th. Cecum adherent and greatly thickened; on releasing the adhesions, white, board-like scars can be seen.

The appendix was of large size and cheesy, breaking off close to the cecum while being enucleated. The deep glands were of considerable size, and extended in a chain upward as far as could be reached. A gland was removed and found caseating. The omentum was converted into a rope-like mass and was adherent to the diseased area. The stump of the appendix was cut out of the cecum and the defect closed by suture.

The parts were iodoformized and the incision was closed without drainage. The diarrhea was checked, and has not yet returned. The patient has gained in weight and strength, but the ultimate result is in doubt. Discharged December 29, 1898.

COLOSTOMY

TUBERCULOUS PERITONITIS*

CHARLES H. MAYO

We can truthfully say that the contagious and infectious diseases have served an important purpose in the development of civilization. By forcing a knowledge of hygienic laws upon the people, compelling isolation of the one class of diseases and the watchful care of the other, and teaching that physical and mental development must go hand in hand, we may hope to bring man near perfection, and reproduce a high type of his kind.

History records the terrible ravages of these diseases when transplanted into virgin soil, as shown by disappearing peoples of the Pacific Islands and the Indians of our own country. We find, moreover, that the wonderful fecundity of the mixed races is held in check by their low physical resistance.

Our knowledge of tuberculosis is keeping pace with the general medical and surgical progress of the age. In considering this question we find the surprising reports from those places in which large numbers of necropsies are made that from 66 per cent. in the United States, to more than 80 per cent. in Germany, of all cases examined show the presence of active, latent, or healed tuberculosis.

These figures are possibly somewhat high for the total population of the countries where they were taken, as such examinations would be made most frequently upon those who had seen much hardship and finally died in some charity hospital. However, the evidence tends to show that while tubercle bacillus often causes great destruction of tissue, it seldom causes death unless the infection is mixed with other germs, if we leave out of consideration the effect produced in the brain.

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* Reprinted from "Denver Medical Times," 1904–05, vol. xxiv, p. 397.

Peritoneal tuberculosis was found 184 times in 13,992 necropsies, collected by Grawitz and Bruin, and noted by J. B. Murphy in his recent monograph on the subject. Barschke found but two cases which he could consider as primary out of 226 cases, the lungs being involved in 200 of the number.

While tuberculous peritonitis is always due to the tubercle bacillus, it is practically always secondary to tuberculosis in other regions. Although it is possible for infection to be introduced to the peritoneum by the blood-stream, the lymphatics, or by extension of tissue, we know as a clinical fact that it does not usually reach it through the tubes, the uterus, appendix, or perforating ulcer. In fact, it would seem that the peritoneum is more resistant to this infection than it is in others, and when the primary focus which supplies the local infection is removed, it is capable of wonderful repair. Owing to the frequency of tubal tuberculosis, we find about four women afflicted to one man. The ages most commonly affected are from twenty to thirty years, although there are some cases in children between the ages of two and five years.

A tuberculous family history is reported in from 30 per cent. to as high as 71 per cent., although the highest does not seem excessive when we consider how commonly the disease is found in some form.

From the pathologic findings, the peritoneal type is usually classified into miliary with ascites, the adhesive or fibroplastic, the suppurative or mixed infection, and the nodular. Wunderlich analyzed 500 cases, which showed 68 per cent. exudative, 27 per cent. fibro-adhesive, and 4 per cent. purulent. Practically, the pathologic findings vary with the purity of the infection and the resistance of the tissue involved. The great majority of the infections are in the lower half of the abdomen, which is always found more extensively diseased adjacent to the source of infection, the inflammation gradually fading as it gets farther away from the primary focus. This is true of almost all varieties of the condition. Tubal infections usually present the purest type of the miliary variety with ascites, the uterus and appendix next. The mixed infections develop the other forms according to the virulence of the contamination.

Tuberculosis of mucous membranes is a chronic condition, leading to ulceration, and in the appendix, and occasionally in the bowel, to perforation. We have seen four cases in the upper abdomen which recovered after laparotomy with removal of the fluid, and in which the source of infection could not be located in the limited examination then made, although many adhesions were found about the region of the gall-bladder, pylorus, and duodenum. The local miliary deposit in the peritoneum and the complete freedom of such condition in the pelvis would tend to refute the old theory of gravity being the cause of the increased frequency of tuberculosis of the pelvis. One was in a man, the other three in women. They were all in older individuals, being from forty to fifty years of age.

Tuberculosis of the peritoneum, as produced by leakage from a local infection of a mucous membrane, is a common cause of ascites. Such cases usually develop exacerbation of temperature from 100° to 103° F., with an evening rise, even in the quiescent stage. It is not uncommon to find a history of more or less pain in the lower abdomen, which seems to be increased by peristalsis of the intestine, and is relieved when the abdomen increases in size with fluid, just as in the case with tuberculous pleurisy. When the infection is in the pelvis, the fluid prevents a thorough examination bimanually. There may often be but little pain upon vaginal examination, and a variable amount of movement can be found in the uterus and adnexa. With less fluid the abdomen is more rigid, often board-like, in this respect, and is, therefore, suggestive of the condition, as it is less painful than the other types of infective peritonitis, and the disease usually has already run a more chronic course.

Many cases of tubal tuberculosis will be found in operating for chronic and subacute appendicitis. It is advisable, particularly in women, to gain an idea of the pelvic condition, if possible, when the abdomen is open and the diagnosis questionable; especially is this true if free fluid is found without sufficient active condition of the appendix to account for its production.

In many instances the only diagnosis possible is a tumor or a condition of the abdomen which will be safer to explore than to leave without knowledge of the effects of the disease of the peritoneum. However, in most cases a fairly exact diagnosis is possible and will be made.

Forty-two years ago Spencer Wells operated upon a case of tuberculous peritonitis unintentionally. The operation was only an incision for diagnosis of the condition, yet the case went on to recovery. Since then hundreds of similar cases have been subjected to the same treatment, with a good percentage of cures. Rouch collected 358 cases, with 70 per cent. of immediate recoveries and 14.8 per cent. of cases lasting more than two years, many of whom were well. Wunderlich collected 344 cases, with 23.6 per cent. of deaths and 23.3 per cent. of cures over three years. Czerny thinks the cures are between 40 and 50 per cent.

The majority of the operations have been by open incision, with a more or less thorough removal of the fluid and closure of the wound without drainage. Occasionally some operators have made a practice of drainage, but with increased risk of mixed infection, intestinal perforations, and also ventral hernia. By many surgeons it was considered a good plan to insert a quantity of iodoform emulsion in glycerin at the time of evacuation of the ascitic fluid. Others remove the fluid by trocar, and inject air into the abdomen. The reasons given as to why relief was obtained were various and many. Some said the effect of anesthesia was favorable; others that the operative trauma produced a reparative effect, and that the reduction of nourishment by removal of fluids and a fresh flow of serum was destructive to the tubercle bacilli. Many thought that the air was influential, and held the abdomen open for a certain period, while others allowed the light to enter the incision as freely as possible. However, it was from some or all of these methods that recovery was frequent from one operation, or in many cases from two or three similar repeated procedures.

It was found by operation, where the condition was general with ascites, that a serous peritonitis was converted into a plastic fibrinous type which walled in the local infection, originally a mucous membrane lesion, and maintained it as a local condition, excluding the general peritoneal cavity from its influence.

In our surgical work upon tuberculous peritonitis we have practised many of the methods in vogue at the particular time the operation was made; but as some cases required two or three operations and a few relapsed after apparent cure, and others were not cured at all, we were gradually led to search for the original lesion and remove it, leaving the peritoneal condition to cure itself, and closing the abdomen without drainage. We have found that the abdominal conditions always point to the source of disease by the congestion, increased matting of the miliary deposit, or increase of general adhesions. There is often a tuberculous node of the tube near the horn of the uterus, and repeated attacks of peritonitis are so many indications of leakage from the tube. A point picked up from a lecture of Murphy some years ago was that in the tuberculous tube the fimbriæ are open and turned out, while in gonorrhea or mixed infection they are turned in closed.

We find that tuberculosis of the vulva, vagina, and cervix is not a common disease, and that tuberculosis of the uterus is uncommon during menstrual life, when the mucous lining is naturally thrown off every month, but, on the contrary, is found before puberty and after the menopause. Tuberculosis of the tube is rather common, and while there is much discussion as to how the infection reaches this location, it nevertheless does, and acts upon the mucous membrane as a local lupus. When leakage occurs, we have developed an irritative peritonitis, yet not always with peritoneal evidence except local congestion. The fimbriæ being open, the ascites caused by leakage prevents what might become protective adhesions. When the abdomen is open and the ascitic fluid removed by sopping with sponges, the serous is converted into a plastic, adhesive variety effectively walling in the tube in the cases benefited.

It would seem impossible that tubal tuberculosis or lupus would cure itself, except by degeneration of the tuberculous deposit and obliteration. The earlier work done, while favorable as far as it went, did not remove the original focus of leakage, and while primary recoveries occurred in a large proportion of cases, many returned for repeated operations and others died within a few months or years of general or local tuberculosis. In fact, Borchgrevink thought the medical treatment as successful as the surgical, reporting 22 operative and 18 medical cases, under the methods at the time in vogue. In our work we have found that the increased percentage of such cases occurred in women from tubal involvement; we also found occasionally in tuberculous peritonitis, even when the tube appeared in fair condition, that drying the peritoneum and closing the abdomen resulted in primary cure, yet some appeared later with pelvic masses, and a second laparotomy, with the removal of caseating tuberculous tubes, resulted in permanent recovery. Such conditions as before stated led us to attempt the removal of the focus of leakage or infection. In some cases the peritoneum is dried in the usual manner, and at a subsequent operation the surgical indications can be accomplished. Of course, patients must be refused operation if their general condition will be such as to render an operation extremely hazardous as well as futile.

In males we make the incision over the appendiceal region, while in women it is arranged so as to explore the pelvis. A tuberculous appendix in an early stage, before miliary deposits appear, may at times be diagnosticated at operation by the large size of the glands of the mesenteriolum.

The utmost care must be employed not to open the bowel in separating plastic adhesions of the intestine, as they are the most difficult fistulas to close, and usually gradually exhaust the patient. As a rule, it is best to keep close to the parietal or pelvic peritoneum, separating as few adhesions as possible in exposing the region affected. In one case we were enabled to locate the uterus in a general mass only by following the round ligament to its attachment. In some cases the tubal enlargement can be pierced and its entire contents of caseating débris and lupoid material removed, leaving the outer fibrous and peritoneal layers *in situ*, then applying iodin or iodoform emulsion in glycerin to the diseased area, and closing the abdomen without drainage. We have made this complete operation on 26 cases of tubal origin, with only 1 death.

These conclusions are based upon 144 operations at St. Mary's Hospital for the relief of tuberculous lesions involving the peritoneum. There were 59 operations for tuberculous peritonitis by the older methods: 42 were cured, 15 improved, and 2 died. There were 58 operations for the removal of tuberculous tubes, with 56 recoveries and 2 deaths, and 27 cases of tuberculous appendicitis without a death.

SURGICAL TUBERCULOSIS IN THE ABDOMINAL CAVITY, WITH SPECIAL REFERENCE TO TUBERCULOUS PERITONITIS*

WILLIAM J. MAYO

The foundation of modern medicine lies in the scientific study of the dead. Postmortem revelations made possible our present knowledge, but we should not forget that it teaches terminal states, and has led to the therapeutic skepticism which has been such a prominent feature of medical thought in the last decade.

The reaction from this nihilistic tendency has come from the surgical side, which has permitted an examination of diseased processes while in an early stage, with corresponding possibilities of cure.

Many of the statistics which have been handed down to us are perfectly true in themselves, but are misleading in their general application. Among these are the statistics of Eisenhardt, who, in 1000 subjects dead from tuberculosis examined in the Munich Pathologic Institute, found 563 with intestinal tuberculosis and not one primary. Quite true; yet, if we studied 1000 deaths from diabetes we should find a considerable percentage dying of tuberculous bronchopneumonia, and, so far as postmortem proof could be produced, there would be small evidence of the diabetes. Compare a little alteration in the islands of Langerhans in the pancreas with the gross lesions in the lung. This is equally true if the primary focus is in the abdomen; it is likely to be overshadowed by the secondary lung changes. Patients with tuberculous strictures in the intestine are referred to the surgeon, likewise tuberculous Fallopian tubes and appendices, and not to hospitals for tuberculosis. The gross changes which took place in the susceptible lung tissue may all be secondary to a local primary focus in any part of the body, yet at postmortem this cannot be demonstrated.

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*Address on Surgery at the meeting of the Mississippi Valley Med. Assoc., Cincinnati, 1904. Reprinted from "Jour. Amer. Med. Assoc.," April 15, 1905.

In 127 autopsies in children Sims Woodhead found 100 with tuberculous mesenteric glands. So firm is the belief in the universal primary lung complication that lengthy articles have been written to show how the mesenteric glands developed secondarily to a chest lesion. The advent of surgery into the abdominal cavity is rapidly eliminating these errors, and experimental work is confirming the clinical testimony which has been produced. The tubercle bacillus is a true parasite, existing only in living tissue, and having no saprophytic properties. Therefore, it does not often destroy its host, otherwise it would kill itself. It is usually the secondary pyogenic infections which terminate life.

In America somewhat over 60 per cent. of cadavers show some form of tuberculosis, active or healed, and in Germany as high as 86 per cent. of cadavers have evidences of tuberculous lesions. The tubercle bacillus may pass the intact intestinal mucous membrane into the lymph-spaces, where they are ordinarily destroyed. In Adami's laboratory it was found that leukocytes passed out on the free surface of the upper intestinal tract and picked up bacteria, especially bacilli, along with particles of fat, and carried them into the lymphatic glands, where they were annihilated. In this way they assisted in securing that relative sterility of the duodenum and upper jejunum which has rendered operations for gunshot and other perforations in this locality so much more favorable than in the ileum and colon. Evidence has also been produced to show that bacteria are carried to the liver through the portal circulation, and there destroyed or strained out with the bile. In this infected bile lies the direct etiology of gall-stones. If the action of the liver is interfered with, the power to overcome or eliminate bacteria is lessened. In 121 cases of cirrhosis of the liver Kelynack found that 10 per cent. had tuberculous peritonitis.

That infected particles are carried to the liver for destruction is further shown by the embolic pneumonia which often follows gastric operations on account of the communication with the general circulation through venous anastomosis about the cardiac orifice of the stomach, although its main channel of venous return is through the portal circulation. The liver and intestines, under equal conditions, are not subject to this disaster on account of their limitation to a portal circulation.

Practising, as my brother and I do, in an agricultural community, we have long noticed the relative infrequency of pulmonary tuberculosis, evidently due to less frequent exposure to inhalation sources of infection, while abdominal, bone, joint, and lymphatic diseases of tuberculous origin are common. Koch showed that healthy animals did not acquire human tuberculosis; neither does the average healthy human being acquire human tuberculosis. It requires either an inherited or acquired susceptibility to the disease.

One cannot help believing that much of the extra-pulmonary tuberculosis is associated with uncooked milk, which is a common article of diet in the country. The difficulties of transporting raw milk to cities limit its use and lead to sterilization by cooking. The work of Salmon, Ernst, and a host of other accurate observers has shown the possibilities of infection through the milk and food-supply. The lungs are the primary source of tuberculosis in perhaps 80 per cent. or more of cases, but this should not lead us to ignore undoubted instances of non-pulmonary origin. Next to the lungs, the most susceptible localities to tuberculous invasion are the tonsils, where the lymphatic tissue lies directly exposed on the mucous surface, and in the intestine and appendix, in which practically the same conditions exist. The structure of the follicles of the tonsils corresponds very closely with that of the large follicles of the intestine and of Peyer's patches. These tissues may permit the passage of tubercle bacilli, but are not necessarily involved themselves.

Inoculation tuberculosis is best studied in surface infections, such as the postmortem finger of demonstrators of anatomy, and as seen in butchers and hide handlers. Regional lymphatic invasion often occurs, and tubercle bacilli may be found in the glandular involvement. There is a marked tendency for the trouble to remain local.

Statistics of postmortem examinations may err in tracing primary lesions on account of the overwhelming character of secondary and terminal conditions. Statistics from the operating room are liable to error because of the limited character of the examination. In St. Mary's Hospital from October 1, 1894, to October 1, 1904, a period of ten years, there have been 6408 abdominal operations performed. Of this number, 5687 were intraperitoneal and 184, or about 3 per cent., were for some variety of tuberculosis. Localized intestinal tuberculosis occurred 21 times: 13 cases were primary and 8 were uncertain.

Tuberculosis of the intestine occurs in three forms: (1) Multiple ulcers due to inoculation from sputum swallowed by tuberculous patients, which at once demonstrates the possibilities of intestinal infection; (2) single, or at most a few, ulcers, usually in the ileum, which have a marked tendency to heal with stricture formation. Such cases come to the operating-table with obstruction; (3) conglomerate tuberculosis, usually of the cecum, at its juncture with the ileum, giving rise to tumor and having the macroscopic appearance of carcinoma. The last two forms are often, if not usually, primary and due to accidental inoculation. The stricture forming ulcer of the ileum may be resected, or an anastomosis around the diseased part may suffice for permanent cure (ileocolostomy).

The tumor-forming variety, with its masses of fibrous tissue in and about the cecum, should be excised, closing both intestinal ends and doing a lateral ileocolostomy. This operation, without excising the diseased focus, leaves an ulcerative mass to its own devices, and the opportunity for removing perhaps the only tuberculous lesion should not be lightly disregarded. In some cases greatly enlarged tuberculous lymph-glands exist in the mesentery, and as many as possible of these should be removed.

We have found tuberculous disease of the appendix as a localized process 29 times (with no deaths) in 1888 operations for appendicitis. (In addition to this number the appendix was removed 629 times not included in these statistics, because secondary to other operations in the abdomen.)

The lymph-nodes in the mesoappendix were often invaded and showed typical caseation on section. Localized tuberculosis of the intestine and of the appendix have occurred in our series of cases in both male and female in nearly equal numbers. Tuberculosis was found localized in the Fallopian tubes 44 times without tuberculous peritonitis, the tubal lesions being securely walled off.

Authorities disagree as to the manner in which the infection invades the tubes. Is it through the circulation, or is it, like gonorrhea, an ascending infection; or is it possible that tubercle bacilli, finding their way to the peritoneal cavity from any source, at once attack this favorable soil? Tuberculosis of the vulva, vagina, and cervix is very rare. Tuberculosis of the uterus is not only rare, but is largely confined to young girls before puberty and to women after the menopause, while tubal tuberculosis is typically a disease of menstrual activity, being most common from the twentieth to the fortieth year. The ability of the tubercle bacillus to pass through the intact mucous membrane and to travel in the lymph-spaces to a suitable soil like the Fallopian tube is suggestive of an ascending infection. We have recently had a typical case of acute tuberculous pus-tubes with tuberculous peritonitis coming on three weeks after confinement and operated on two months later.

Those interested in the question should read Murphy's monograph on "Tuberculosis of the Female Generative Organs." I will, however, take this opportunity to call attention to the relative frequency of tuberculous peritonitis in the male and female. At the operating-table we found about four females to one male. Osler found somewhat over two females operated on to one male. In other words, between the ages of twenty and forty years tuberculous peritonitis is certainly very much more frequent in females, and, so far as direct sources of infection are concerned, the tube is the one which may explain this difference in frequency. *There were 89 cases of tuberculous peritonitis, with 3 deaths, in our series of cases.*

The majority of cases operated on in St. Mary's Hospital who left the hospital improved but failed to remain so returned for further treatment. A considerable percentage did not maintain the improvement, and, in the course of years, patient after patient returned with a relapse of the peritoneal condition or some other form of tuberculous infection. Some returned four or five times, and for further operation. It became evident that, in a considerable percentage of cases, there was some source of reinfection of the peritoneum after apparent cure.

About three years ago Murphy called our attention to the fact that in tuberculous peritonitis with ascites in women the Fallopian tube of one or both sides would usually be found open; that is, an eversion of the fimbriæ with thickening of the tube, and especially of the mucous membrane. We have had an opportunity to verify this in a considerable number of cases. We further noted that, in some instances, after removal of the fluid by laparotomy with cure of the peritoneal condition, masses which had not previously been felt could be detected in the region of the tubes. This observation was confined to a few patients, but it led us to examine the pelvic condition of every case of tuberculous peritonitis which was operated on. Investigation showed marked tuberculous thickening of the tubes in the majority of such patients. On removal, these tubes showed typical lupus of the mucous membrane, with cheesy deposits, and in a number of specimens we were able to stain tubercle bacilli in the tissues. In a minority of cases the tubes were found to be normal.

Having under observation a small number of patients in whom simple laparotomy had failed permanently to cure tuberculous peritonitis, we began to do a radical operation, performing hysterectomy with removal of ovaries and tubes. The condition of the uterus and ovaries, on examination, did not justify a procedure so mutilating, the tubes showing unmistakable evidence that they alone were the source of reinfection. It became clear that in tuberculosis of the peritoneum in the large majority of women a lupus of the mucous membrane of the tube was the source of infection of the peritoneum, and that the latter condition was secondary to the former, a conservative process on the part of nature in an attempt to absorb products of tubal tuberculosis turned loose in the peritoneal cavity. Some of these operations have been among the most trying of our surgical experience, adhesions matting the intestines, bladder, and uterus into a confused mass, with free fluid in the abdominal cavity, the tubes occupying the part of a roughly walled-off foreign body. In several instances the anatomy was indistinguishable, the uterus and tubes being located by tracing a round ligament from the abdominal wall downward. One is in constant fear of doing irreparable damage to the bowel or other viscus, with a resulting fistula which would be impossible of closure. By patience and care we found it possible to enucleate tuberculous tubes in 26 cases of tuberculosis of the peritoneum. If the wall of adhesions was fairly good, a pus-tube containing a quantity of tuberculous débris and cheesy deposits was found. The intestine, and especially the sigmoid, often showed a thick white degenerative patch, caused by extension from the tubes. Sometimes a tube of one side communicated freely with the peritoneal cavity, while the opposite side was more or less boxed off and contained products of the tuberculous disease. Occasionally a tube on one side was converted into scar tissue with complete obliteration of the mucous membrane cured by natural processes, while on the other side active disease was present. This last variety was most interesting as showing that nature did cure at times, and by the usual process of development and contraction of fibrous tissue.

In practically all these cases the peritoneal involvement was greatest in extent near the seat of local infection; this has been generally noted, and heretofore ascribed to gravity. It is more likely to be due to proximity to the seat of infection. This is further borne out by those occasional patients with limited collections of fluid caused by tuberculosis of the pelvic peritoneum, and which so much resembles ovarian cystic tumors. Spencer Wells accidentally cured the first case under misapprehension that it was an ovarian tumor. In tumor-like collections of fluid an open Fallopian tube will usually be found to communicate with the interior of the sac. Two such cases in our late experience demonstrated this condition perfectly. There was a sacculation having the physical appearance of an ovarian cystoma, the size of a seventh-month gestation; the tubes were tuberculous and projected well into the cavity. In both cases we were able completely to enucleate the newly formed sac and the tubes.

Theories as to the reasons for the curative effects of laparotomy in tuberculous peritonitis are too numerous to mention; Gatte gives more than 20. It appears to us that simple laparotomy, with removal of the fluid, acts in two ways: (1) In tubal disease the fluid mechanically separates the fimbriated extremity of the tube from the surrounding tissue; (2) after removal of the fluid, contact with neighboring structures, with resultant adhesion, may follow. This prevents peritoneal reinfection, confines the products to the pelvis, and accounts for the lateral pelvic masses which are sometimes developed after the disappearance of the fluid. It also enables nature to bring her resources to bear on a localized focus, and develops the self-cure which was noted in the cases mentioned. Undoubtedly the operative manipulation causes serum to be poured out, and thereby increases the peritoneal powers of absorption. Lupus of mucous membrane in any part of the body is a most stubborn form of tuberculous disease. The Fallopian tube is no exception to the rule, and, in addition, seems to have a selective affinity for tubercle bacilli, in this respect nearly resembling the alveoli of the lungs. As previously noted, the frequency of tuberculous peritonitis in women is several times greater than in men, and this certainly confirms in a remarkable degree their peculiar liability on account of tubal lesions, in this respect agreeing with the splendid work of Williams.

In carrying out these investigations of the pelvic conditions in women with tuberculous peritonitis, we found in a minority of patients no tubal disease, but a well-marked chronic appendicitis with enlarged glands in the mesoappendix. On section the glands showed typical caseation. In many instances the region of the greatest distribution of tuberculous peritoneal nodules could be shown near the appendix. In some cases neither the tubes nor the appendix was diseased, and the origin was doubtful. In four persons tuberculous peritonitis was found limited to the upper abdomen above the transverse colon. These patients had well-marked symptoms and were operated on under the impression that the trouble lay in the gall-bladder, duodenum, or stomach. The ages ranged from thirty-six to fifty-six. We could not trace the primary source of infection; 3 were in women, 1 in a man. In a series of cases operated on in St. Mary's Hospital during the present year there were 16 cases of tuberculous peritonitis; of these, 11 were women, in 9 of whom the origin was in tuberculous tubes, 1 in the appendix, 1 unlocated; 5 were in men, 3 with tuberculosis of the appendix and cecum, 2 unlocated.

In a most exhaustive analysis of the subject Fenger sustained the opinion by Borchgrevink, who claimed that medical cures were as numerous as operative cures, and that it was not proved that tuberculous peritonitis was a surgical disease, even in its most favorable form, in which ascites was the prominent feature. So strong was he in his conviction that tumor-like collections of fluid existing in the pelvis were not excepted. The assertion was too sweeping, and one which the trend of surgical thought had failed to sustain. In a most excellent résumé of this subject before the American Surgical Association, 1902, Ochsner proved beyond question that laparotomy and evacuation of the ascitic accumulation had a most beneficial effect on the disease. While simple abdominal incision and drainage have failed to cure all the cases, the procedure did cure many and usually gave relief for a time. If reinfection could be prevented, the cure might be expected to be permanent in a much larger number of cases.

Can we prevent relapse? Certainly we can in many instances. Of the 26 radical tubal operations we have made on cases of tuberculous peritonitis, 25 recovered; of these, 7 had been operated on by simple laparotomy from 1 to 4 times previously. In not a single patient as yet has another operation become necessary, and, as contrasted clinically with a preceding group of equal number, the favorable results are most striking. There is usually a temporary continuance of the peritoneal effusion, but reinfection has not occurred. The outcome where the appendix has apparently been the seat of trouble has been favorable, but not so favorable as in the tubal form of the disease.

It appears to us that ascites has been more common in women with tubal tuberculosis, while in both males and females fibroplastic forms have been relatively more common where the appendix or an unlocated intestinal lesion has been made the source of peritoneal invasion. This latter condition is probably due to a mixed infection, but the secondary organism is evidently short-lived, and we find its results only at operation. We have seldom operated on the fibroplastic adhesive form, and we have been slow to operate in any case during the acute stage.

In tuberculous peritonitis in women we evacuate the fluid and place the patient in the Trendelenburg position, packing off the general abdominal cavity in the usual manner. The pelvic organs, appendix, and cecum are examined. If the Fallopian tubes, appendix, and cecum are diseased, they are removed. The stumps and walls of tuberculous abscess cavities are dried, a little sterile iodoform is rubbed in, and the abdomen closed without drainage. Drainage sometimes leads to secondary mixed infection with resulting fistulas, which have a great tendency to become fecal.

In men the incision is placed to the right of the median line over the appendix. The fluid is evacuated, the appendix and cecum examined, after which a radical operation, if indicated, is performed.

From the narrative of facts and observations so briefly set forth I think we are justified in the belief that the failure of simple laparotomy and evacuation of fluid exudate in tuberculous peritonitis to maintain a high place in surgery is due to reinfection from lesions in the mucous membrane of the Fallopian tube, appendix, or some part of the intestinal tract. We have been treating a symptomatic peritonitis instead of removing the source of disease. That many times the infecting lesion cannot be discovered is true, and it is equally true that not all cases can be explained in this way. Experience teaches that, under expectant treatment, many of the primary lesions are cured by natural processes. Simple laparotomy and drainage aids recovery in a remarkable manner. Radical operation on the primary lesions in tuberculous peritonitis will greatly increase the percentages of cures and prevent reinfection of the peritoneum.

It seems reasonable to suppose that tuberculous peritonitis has its origin in a local focus in practically every case, as is true in septic peritonitis. Peritoneal reinfection may be prevented if the local focus can be removed. Whether the patient will regain and maintain general well-being must depend to a large extent on whether the local focus thus removed is primary or secondary, and, if secondary, as to the possibilities of cure of the chief seat of disease.

INTESTINE (CECUM)

INFLAMMATIONS INVOLVING THE CECUM, ITS APPENDIX, OR BOTH*

WILLIAM J. MAYO

We all know that the "inflammation of the bowels" of the older writers was, in the majority of instances, typhlitis, or perityphlitis, and as we become more familiar with the clinical symptoms of these pathologic changes we are impressed with the many errors which have been made in diagnosis. This retrospect will include many cases of supposed typhoid fever, idiopathic peritonitis, or pelvic abscess.

The cecum, lodged in the right pelvic and iliac fossa, is in the nature of a pouch with two openings in its upper extremity; at its lowest point is a slit-like opening into the appendix. It is very distensible, covered by peritoneum, and, though more or less fixed to the psoas muscle by connective tissue, is capable of a considerable range of motion. The location of the internal and external posterior longitudinal bands of muscle should not be forgotten, as their resistance may assist in directing pus or limiting an abscess. The anterior band is of less importance in this connection.

While the appendix may be a very useful canal in some lower orders of life, its fetal remains have proved to be an unlucky inheritance to man. It varies much in size and location, but, as a rule, extends upward and inward and is adherent to the posterior wall of the cecum.

This crude survey of the topography of the region is made to demonstrate the anatomic reasons why small bodies or fecal concretions may gravitate into the cecum and thence into the appendix, and how the resulting abscess, in this little death-trap, may be influenced, in its point of easiest rupture, by the length and direction of the appendix, and its relation to the cecum and its longitudinal bands. We gain also a clear conception of the possibility of free fecal passage over a distended cecum, with resulting freedom from the obstinate constipation which is usually expected.

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*"Trans. Minn. State Med. Society," 1888, pp. 63–72.

I will not take up your time with a discussion of new-growths, intussusception, or those processes in which the cecum, in common with other portions of the intestine, participates, but will call your attention for a few minutes to the subject of fecal impaction, which can ordinarily be separated from typhlitis or perityphlitis by the presence of a doughy tumor extending upward into the colon without marked signs of inflammation and a general tendency to depression and often melancholia, as the following case will illustrate:

Case 1.—October 20, 1887, Mrs. A. W. Had suffered some months with anorexia, constipation, and marked melancholia. The patient was emaciated, and, except an impacted cecum, had no discoverable lesion. Enemata of from two to four quarts of water, given in the knee-chest position, produced large evacuations of scybalæ, with corresponding improvement.

This case also illustrates the "fecal anemia," as pointed out by Sir Andrew Clark.

These fecal tumors are often of large size and not accompanied by constipation, and may be due to pressure, as in Case 2:

Case 2.—Mrs. G., aged forty-six years; had an abdominal tumor which was diagnosed by several surgeons as a double ovarian, a distinct mass being felt in the right side of the abdomen, as separate from the larger left cyst, and thought to be a second tumor, involving the right ovary. She was not constipated. On March 10, 1888, we removed the ovarian cyst, and the second enlargement was with much difficulty made out to be an enormous fecal impaction of the cecum, which had existed for nearly two years, and was evidently due to the pressure, as it disappeared rapidly after the operation.

Typhlitis, or inflammation of the cecum primarily, of sufficient magnitude to give rise to prominent signs locally, has been rare in our experience, and always the result of fecal impaction, the common catarrhal inflammations not producing the heat, redness, and swelling which so often result in abscess formation.

The following interesting case is one of the few cases of pure typhlitis we have seen:

Case 3.—The patient, fifty years of age, had been an inmate of the female ward of an insane asylum for a number of years. For a week previous to the time she took to her bed it was noted by the attendant that she appeared in pain and walked in a bent position, but made no complaint. Upon examination a large, brawny, red swelling was discovered in the cecal region and extending into the lumbar. Just above the anterior-superior spine of the ilium was a dry brown scale resembling a bed-sore, which was due to internal pressure. The diagnosis of fecal impaction, with resulting typhlitis, diffuse suppuration, and fecal extravasation was confirmed by the postmortem.

We come now to a class of cases in which we believe the cecum to be secondarily affected. These patients are usually young adults, and present more or less well-marked symptoms of inflammation in the cecal region. The attack is often preceded by digestive disorders and ushered in by vomiting, which ceases when the stomach is emptied of its contents. Locally, there is some enlargement, pain, and tenderness upon pressure. The general symptoms are those of inflammation, with quickened pulse and slightly elevated temperature. Constipation is the rule. After several days and under appropriate treatment many recover, but if, instead of improvement, the local signs increase, with pain radiating down the thigh or into the testicle, the thigh flexed on the body, and with symptoms of general prostration, pinching of the face, and marked symptomatic disturbance, a probable diagnosis of pus-formation is made. If chills, sweating, hiccup, and a tendency to vomiting from obstruction are added to these symptoms, we recognize a grave condition: that of abscess involving the appendix or a primary perityphlitis.

If this abscess ruptures into the abdominal cavity, death results; if into the cecum and thus outward, recovery is probable; if into the cellular tissue, a secondary abscess is formed, which in turn may rupture into the cecum or other portion of the intestine, the bladder, or dissect its way upward to the surface and form fistulous tracts in any direction, and only too frequently into the abdominal cavity.

That a large proportion of these cases have their starting-point in the appendix is proved, and in those cases which improve early we must conclude either that resolution took place or that the abscess containing the foreign body was early ejected into the cecum. That this often occurs is rendered very probable by the cicatrices which are frequently found about the appendix in the course of general postmortems where death had resulted from other causes. The frequent relapse, after several months, in just this class of cases resembles a pyosalpinx or a lacrimal abscess, and, like such, may be due to causes similar to the original, and are seldom of the same gravity as the primary attack.

In the cases which progress further we must conclude that the abscess, originating in the appendix, ruptures into the cellular tissue, forming a secondary abscess, which is limited by adhesions and directed by resistance of tissues. This condition requires our best judgment to control by surgical means. While many of these abscesses may spontaneously discharge into some viscus having an external exit, or even become superficial and open externally, such fortunate termination cannot be expected, and an operation or death is the alternative in most cases. In those cases where death follows insignificant symptoms, the abscess in the appendix ruptures at once into the abdominal cavity, producing a fatal peritonitis.

No one symptom is always present in this disease, and almost all the usual signs may be present; especially is this the case in the apathy of severe disturbance of the sympathetic system, where the dilated pupil of the eye, darkened skin, pinched features, quick pulse, with normal or subnormal temperature, indicate the gravity of the process more than the local signs. Tympanitic distention may also obscure the outward appearances. A fullness in the vault of the rectum on the right side is often found, and the abscess has been opened here and drained (Edmund Andrews). While the term perityphlitis does not express the exact origin of the disease, it is the one we have retained because in common use. Appendicitis would be the proper term.

It is not important to our patient to know whether the cecum is primarily or secondarily affected, but it is important to evacuate pus early. How early? As soon as it can be detected. It must be apparent to all that if the dictum of some of our most ambitious surgeons be followed, to operate in every case in three or four days, many patients will suffer from a formidable operation unnecessarily. It is doubtful if many who might be saved by operation would die before the end of the first week; patients who die before this time can seldom be diagnosed before fatal peritonitis supervenes.

MANAGEMENT OF CASES

We enjoin absolute rest. Food of a light and easily digested character, and sufficient opium to relieve pain. Externally, hot fomentations applied continuously, and in the later stages of convalescence blisters are used to aid the resolution of remaining induration; if they be used early, they tend to obscure the local signs by masking the surface appearance and increasing the cutaneous hyperesthesia.

In suitable cases, after we are satisfied that the adhesions limiting the abscess are fairly firm, we administer an anesthetic (chloroform preferred, as less likely to excite vomiting), and making an incision over the long axis of the tumor, dissect down to the peritoneum. If the peritoneum be reduplicated in front of the abscess, any opening made into it is carefully closed with catgut and the dissection continued lower down. Upon reaching the mass of inflammatory tissue surrounding the pus cavity the grooved needle is most useful as a guide, but after entering the sac the point of the needle should be directed away from the intestines, since, when the abscess is incised, the intestines are forced rapidly down by the diaphragm and might be injured by counterpuncture. After introducing a drainage-tube of stiff rubber or glass, if a small slit be made in a piece of rubber dam and drawn over the projecting end of the tube, the pus can be conducted away from the wound and prevent soiling the patient. As a rule, we do not wash out the cavity for a day or two, but let it discharge slowly.

There are a few moot points worthy of attention, and one is in regard to the use of the hypodermic needle. We can only say that we have found it most useful in diagnosis and have seen no harm result. While the treatment of septic peritonitis of a surgical character is benefited by laxatives, we are certain that, in those cases where the peritonitis is local, and, by forming adhesions, protective in nature, laxatives are positively harmful, and, by increasing peristaltic action, tend to premature rupture and a fatal result. It should be remembered that Alonzo Clark, the great advocate of the opium treatment, was engaged almost exclusively in purely medical practice, and met with this form of peritonitis rather than surgical or puerperal. In regard to primary laparotomy, we do not believe it good, sound practice, unless the abdominal cavity has been opened by the abscess, under which circumstances it is demanded, and with thorough cleansing, suture, and drainage, has saved lives. While the peritoneum might deal with a small amount of pus in these cases, any one who has seen the stinking pus and feces from a perityphlitic abscess would be willing to wait for adhesions to render the operation extraperitoneal, rather than risk the slightest contamination of the peritoneal cavity.

Before citing a few illustrative cases, we wish to call attention to the comparative frequency of phlegmasia dolens, in one or both legs, as a sequel of perityphlitis, and would remark that we have never seen this complication follow true typhoid fever.

Case 4.—M. B., male, aged twenty-eight years. During the summer of 1885 this patient developed a typical perityphlitis, with moderate general symptoms and well-marked local signs. On the tenth day there was a copious discharge from the bowels of pus and feces, with gradual recovery. Since this time he has had four similar attacks of lesser gravity up to one year ago. During the past year he has been entirely free from recurrence. This patient represents a considerable number of similar cases, though not all of so fortunate a termination.

Case 5.—Alice B., aged nineteen years. In November, 1887, the patient was suddenly attacked with severe pain in the right iliac region, and shortly developed well-marked symptoms of perityphlitic abscess. The temperature was unusually high, ranging from 103° to 104.5°, and in many respects resembled typhoid fever. There was no constipation during the entire attack. At no time was dullness on percussion marked over the cecum, and rectal touch revealed the fact that the induration was on its anterior wall. At no time were we able satisfactorily to diagnose pus with the hypodermic needle or otherwise. On the fourteenth day there was discharge of pus through the bladder and tedious convalescence, delayed by a phlegmasia dolens of the left leg. The abscess evidently formed behind and internal to the cecum, which it elevated, and passed inward behind the bladder, pressing upon the left external iliac vein before opening.

Case 6.—E. R., male, aged thirty years. This patient was seen in February, 1888. He was in the second week of his illness, and presented typical signs of perityphlitic abscess, though we were totally unable to detect pus. During the third week the patient became much prostrated, bowels were not constipated, yet there was some nausea and vomiting of a character to intimate pressure and partial obstruction of the small intestines. On the twenty-third day of his attack the vomiting increased in severity and the constipation became obstinate. On the twenty-fourth day he vomited three pints of pus and feces, and several hours later like discharges took place from the bowels, with recovery. In this case the attachment of the abscess was undoubtedly to some portion of the small intestines near the stomach.

Case 7.—M. P. R., male, aged twenty-six years. July 2, 1887, this man was seized with violent pain in the right iliac region, with general and local signs of perityphlitis. On the seventh day his condition became so critical that an operation was proposed and accepted. Deep dissection opened a large abscess cavity, which discharged over a pint of fetid pus. Prompt recovery followed.

Case 8.—E. M., male, aged twenty years. This young man was taken on August 1, 1887, with supposed cholera morbus. The nausea, vomiting, and dysenteric discharges, of a greenish color, continued unabated in spite of treatment. During the succeeding six days his condition became worse, tympanites developed, temperature subnormal, and pulse continually above 130. With the exception of decubitus, there was nothing to indicate abscess, but on the eighth day his condition became so desperate that any chance of relief was to be entertained, and with but slight expectation of finding pus a hypodermic was introduced in the cecal region and withdrawn full of pus. An operation was immediately performed, and over a quart of pus withdrawn. Complete recovery followed.

Case 9.—L. Z., aged seventy-six years. In July, 1887, this old gentleman complained of soreness in the cecal region, constipation, and fever, during most of this month being confined to his bed with colicky pains, indigestion, and general prostration. His constipation was relieved only by large doses of castor oil and turpentine, administered occasionally. The tumefaction in the cecal region gradually increased upward and backward, became brawny, and was finally opened by deep incision. In the eighth week of his illness large quantities of pus of strong fecal odor were discharged. The incision was made over the gall-bladder, being unusually high, but was at a point where deep fluctuation was discovered. The patient did fairly well for a month, but gradually sank and died from protracted suppuration.

This last is one of several cases where large quantities of pus have been removed by superficial incision several months after the initial attack, and in younger persons usually ended in recovery.

The cases reported in this paper occurred in the practice of my father, W. W. Mayo, my brother, C. H. Mayo, and myself.

THE ILEOCECAL ORIFICE AND ITS BEARING ON CHRONIC CONSTIPATION, WITH REPORT OF TWO CASES RELIEVED BY OPERATION*

WILLIAM J. MAYO

Miss E. V., aged twenty-one, was admitted to St. Mary's Hospital on August 14, 1899, with the following history:

She has been obstinately constipated since a child. This condition has increased with years, and now requires the use of a large amount of laxative to secure a fecal movement. For a year or more has suffered from pain in the region of the appendix, which is much aggravated by the use of the necessary remedies for the relief of the constipation. At times this right-sided pain confines her to her bed for several days.

Examination.—A strongly built female of 140 pounds in weight; general appearance anemic; color pale; tongue coated. No evidences of disease beyond a soreness in the region of the cecum and some muscular rigidity at this place.

Upon the history of the obstinate constipation, the attacks of right-sided pain lasting several days at a time, and the local tenderness a diagnosis of chronic appendicitis seemed reasonable, and on August 16th the appendix was removed. There were a few adhesions about the appendix, but not enough evidences of disease to account for the symptoms. It was noticed at this time that the small bowel was quite full of material in spite of the previous energetic purgation. At the juncture of the ileum and cecum the caliber was reduced markedly, having almost the appearance of a string tied around it sufficiently tight to reduce the lumen one-third. There were no evidences of previous ulceration nor disease. Nothing further was done at this time. No improvement in the constipation took place following the operation, nor was there any marked relief to the symptoms. December 29, 1899, the patient was readmitted to the hospital and the ileocecal coil exposed. An incision was made 2½ inches in length at right angles to the ileocecal juncture, having its center at that point. The wound was sutured transversely, after the manner of the Heineke-Mikulicz pyloroplasty, making a very considerable increase in the size of the aperture between the ileum and cecum.

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* Read before the Olmsted County Medical Society, March 6, 1900. Reprinted from "Annals of Surgery," September, 1900.

The bowels now act regularly or with slight aid, and in marked contrast to the previous condition. The pain and tenderness have disappeared, and the general condition has vastly improved.

The time which has elapsed is too short to give this case much value, and my purpose in reporting it is to call attention to some facts which a superficial investigation of the subject has brought forth, and to some deductions from the facts which may be and probably are true.

The literature bearing on the subject as to function of the ileocecal valve is meager. It seems to be taken for granted that its main purpose is to prevent the return of material of any kind from the large into the small bowel, and there is no doubt that this is one of its functions. The ileocecal valves consist of two semilunar folds of mucous membrane, situated one superiorly and the other inferiorly, leaving a transverse slit between at the point of juncture of the ileum and cecum. On one side of the valve is the mucous membrane of the small bowel; on the other, that of the large intestine. Immediately at the base of the valves is a circular fold of muscle-fibers forming a constrictor muscle having much the appearance of the pylorus. The mechanism of the ileocecal opening certainly bears out the view that one of its main functions is to prevent the too rapid emptying of the small bowel, and to maintain some pressure against peristalsis until the process of small bowel digestion is properly completed. It naturally follows that if, for any reason, the barrier to ready egress be excessive, partial retention of small bowel contents takes place, and a small bowel constipation, so to speak, with a resulting train of symptoms due to fermentation and absorption, necessarily results.

The slow delivery of the intestinal contents into the large bowel, and perhaps in a condition changed from the normal, predisposes to constipation, the large bowel being indirectly rather than directly at fault.

There is no means at present of estimating the effect on intestinal digestion of partial obstruction, and especially so in a minor degree; yet if we look at the effects of even slight obstructions at orifices having a similar function, such as the outlet of the stomach, urinary bladder, etc., we cannot but be struck with the remarkable similarity in results—a more or less painful excretion. The secretions in the small bowel are alkaline, in the large bowel slightly acid, and in the production of this change gases are evolved which materially aid the passage of fecal matter along the large bowel. The thinness of the muscular coat of the large bowel and its sacculation make it evident that flatus is a necessary adjunct to fecal progress. It becomes a question, also, as to whether or not the greater amount of absorption which takes place in the small bowel under such circumstances leaves the contents, when passed, in a condition less favorable to stimulate the peristalsis and production of gases in the large bowel. The writer has in eight cases eliminated the ileocecal mechanism as a factor in the intestinal circulation, either by removing the parts for malignant or tuberculous disease or by an ileocolostomy, and in each instance the bowel movement became looser and more frequent than previous to the advent of the disease for the relief of which the operation was undertaken; showing that, if the ileocecal valves are not present, the fecal circulation in the large bowel is rendered more active.

In going over the anatomy of this region, and in a few dissections, I have noticed that the terminal portion of the ileum comes upward out of the small pelvis, forming somewhat of an acute angle near its insertion into the cecum. The mesentery of the ileocecal coil is of good length, but at a point just above this portion of the lower ileum the mesentery is shorter. It is in this lower portion of the ileum that typhoid perforations are most common, and this question of the vulnerability of the lower ileum to infectious processes brings up the important point: What will be the effect of enlarging the orifice in permitting a freer communication between the bacteria in the large and small bowel, especially the colon group? So far as I am able to learn, in the few cases in which this has been done for diseased processes no harmful effect has been noted.

Since I have had this subject in mind I have examined with some care the ileocecal coil in the course of a number of abdominal operations to see if there was any ready way of estimating the size of the ileocecal orifice. In most cases an inspection will reveal any marked abnormality. Some information can be gained by causing the finger to invaginate the wall of the ileum into the cecum, and in a few cases the cecum into the ileum in a manner similar to the process of invaginating the finger against the scrotum into the external hernial ring.

I had an opportunity to repeat the operation on an inmate of the Rochester State Hospital for the Insane. The history of this case is briefly as follows:

Miss L. C., aged twenty-five years, was admitted to the Rochester State Hospital for the Insane November 2, 1898, suffering from melancholia. In the history of the case previous to admission constipation of the most obstinate character was about the only symptom of physical ailment. Since coming to the hospital she has suffered from constipation, which has required the usual remedies in large quantities, and, in spite of constant watchfulness, has had a number of attacks of obstipation. During these attacks there has been soreness in the cecal region.

Examination.—An anemic girl of slender physique. On pressure, a sensitiveness in the region of the appendix was apparent, with rigidity of the right rectus muscle. Abdomen was somewhat distended with gas.

The diagnosis of chronic appendicitis seemed justifiable, based on the previous attacks of pain and obstipation and the present tenderness.

Exploration February 27, 1900, revealed a normal appendix. The ileocecal coil was drawn out and examined; the same condition was found as in case No. 1—an unusual narrowing of the aperture between the small and large intestine. A plastic operation was performed similar to the previous case. An incision three inches in length was made into the lumen of the ileocecal coil in the direction of the small intestine, having its center at the superior valve, which it divided. This wound was closed transversely.

The mere fact that two cases have been relieved of pain in the region of the cecum and constipation by a plastic operation which enlarges the caliber of the ileocecal opening does not warrant that any conclusions should be formulated. It is well understood that chronic constipation is ordinarily a disease of the large bowel; but I believe that there are certain cases in which an organic or functional narrowing of the ileocecal opening is responsible for a train of symptoms of which pain in the region of the cecum, without marked disease of the appendix, and chronic constipation are important symptoms.

[Note.—May 17, 1900: Within a few days I have examined both of these cases. The constipation in each has practically disappeared, and the general condition has greatly improved.]

CARCINOMA OF THE CECUM, WITH REPORT OF CASES IN WHICH THE CECUM WAS REMOVED FOR MALIGNANT DISEASE*

WILLIAM J. MAYO

Ileocecal carcinoma is not an infrequent malady. In a collection of 1148 cases of intestinal cancer Ewald found 64 in the cecum and 26 in the ileum, and more than half of the latter involved the ileocecal valves. Bland-Sutton says that of 100 cases of intestinal carcinoma, 75 will involve the rectum, 23 the large intestine, and but 2 the small bowel. Frank's table shows that two-thirds of all cancers of the large bowel involve the cecum and sigmoid flexure, and in about equal proportion. From these statistics it can be estimated that 7 per cent. of all malignant diseases of the bowel involve the cecum. Sex does not seem to have much significance. The average age of patients with carcinoma of this organ is somewhat younger than those with malignant disease in other parts of the body, and while not frequently found in the young, it is sufficiently common to warn us against laying too much stress on the age of the patient.

Among the most frequent of the attributed causes for this condition is constipation, but if this is an important etiologic factor, it would seem that the disease should affect females more often than males; yet this is not the fact. Maylard states that primary carcinoma of the intestine is always of the columnar-cell variety, and Furnival points out the frequency of colloidal changes, particularly in the young. Lymphatic infection is found in less than one-half of the cases dying from intestinal carcinoma. In 112 collected autopsies Haussman found that 55 were limited to the gut, the remainder showing lymphatic involvement in 36 cases and general infection in 21 cases. More than one growth is seldom discovered, although two or more points of disease have been reported; whether all were primary or from a single source of infection and carried to the situations found by implantation or arterial emboli it is impossible to state.

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*Read at the Fifty-second Annual Meeting of the American Medical Association, in the Section on Surgery and Anatomy, and approved for publication by the Executive Committee of the Section: Drs. W. J. Mayo, H. O. Walker, and A. J. Ochsner. Reprinted from "Jour. Amer. Med. Assoc.," October 19, 1901.

The disease originates most frequently at the ileocecal juncture, and has the tendency of all carcinomata of the large bowel to form a ring-like constriction, although a considerable tumor may exist without obstruction. The duration may be prolonged, and its course before active obstruction supervenes is usually slow. Briddon reports a case of twelve years' probable existence. Death usually results from obstruction or perforation, the latter either just above the stricture and close to it, or at some point in the cecum from distention; perforation is somewhat more frequent (7 to 4).

The distention ulcer in the cecum is similar in pathology to the distention ulcer in the small intestine, about which Kocher has written so interestingly. The symptoms of malignant stricture of the cecum are colicky pains, constipation alternating with diarrhea, and progressive wasting. A tumor may be felt in some cases. In the later stage intestinal peristalsis can be plainly seen through the attenuated abdominal walls, and is usually accompanied by marked gurgling. Other cases present symptoms of chronic appendicitis with an induration indicating a small inflammatory deposit about the appendix. This was the condition of two of our cases. As the obstructed material is largely accumulated in the small bowel, symptoms of gastro-intestinal irritation are more marked than if the large bowel only was involved. A few cases are ushered in without premonitory symptoms by an attack of acute obstruction. König, Körte, Barton, and others report cases in which an acute intussusception was the first sign of trouble.

The differential diagnosis between malignant stricture of the cecum and simple or tuberculous strictures may be impossible without exploration. In a paper on "Localized Tuberculosis of the Intestine," read before the Minnesota Academy of Medicine February 1, 1899, I reported three cases of tuberculosis of the cecum, and I have met with one additional case since that time. In these cases the foul discharges from the bowels, slight but constant temperature, tendency of the tuberculous mass to soften, taken into consideration with the previous history, made a diagnosis possible, although the obstructive phenomena were essentially the same.

Cases of chronic inflammatory thickening of the cecum have been reported, giving much the same signs, and are, in some cases at least, syphilitic in origin. Impaction of feces in the cecum is not so very infrequent, and may remain months, if not years, without dislodgment. In one case which I examined some twelve years ago an inmate of the Rochester State Hospital for the Insane, such an impaction was known to have been present for several years, and finally, by atrophy necrosis, ulcerated to the surface of the body. Dermoid or other tumors of the abdominal muscles on the right side may confuse the diagnosis. In the one case of dermoid which I have seen the differentiation was most difficult. Dermoids are rare, and usually occur in the female following labor. There is no history of intestinal obstruction.

Acute obstruction of the bowels is a frequent complication of the malignant process, and its relief a prerequisite to a successful outcome. Treves, speaking of intestinal obstruction generally, says that he reduced his mortality 50 per cent. by relieving the distended intestine above the obstruction. This has been done by a simple incision or aspiration (Greig Smith) or the use of Paul's tubes. The common method of relief has been that of forming a temporary artificial anus in the large intestine. In such cases three operations are demanded: (1) Relief of the obstruction by the artificial anus; (2) resection of the diseased area, and (3) closure of the anus. This last procedure has a mortality of its own. Makins reported 39 intestinal resections for the closure of an artificial anus—21 were cured, 3 unimproved, and 15 died.

From an operative standpoint the ileocecal coil should be considered independently. In cancerous or other obstruction of either the large or small bowel the normal condition above and below the disease is identical, but in this situation the small bowel empties its contents in a fluid state into the large intestine, in which the feces assume solid form. The question is not one of ordinary intestinal union in which two parts of similar bowel are joined, but one in which, by reason of the dissimilarity, an anastomosis can be effected under very favorable circumstances.

In ileocecal obstruction the ileum can be joined laterally with the transverse colon. The obstructed intestinal contents are fluid, and do not endanger the union, as is the case with the solid accumulations in the large bowel, and the size of the receiving intestine and its nearness to the anal orifice give it all the advantages of an artificial anus on the surface of the body. The union can be effected at a point sufficiently high on the ileum to secure healthy bowel for approximation. There is also the great advantage in that the communication is permanent. The extirpation when performed later is more easily effected, both ends of the intestine being turned in and closed. We have performed ileocolostomy for various causes six times, in this manner, using the Murphy button, and all the patients recovered from the operation. In four of these cases nothing was attempted in a radical way on the diseased part, the discharges draining satisfactorily from either side of the obstruction. Exclusion of a portion of the intestine can be safely accomplished, provided there is some exit for the secretions of the excluded part, but, as shown by the studies of Kammerer, if the exclusion is absolute, future trouble can be expected.

Resection of the cecum was first performed by Billroth in 1876. The operation has now been done many times, and a large number of cases have been reported. The operative mortality, as given by Greig Smith, was between 30 and 40 per cent. Furnival estimates the mortality of the more recent cases as somewhat less—20 to 25 per cent. In 95 reported cases involving the cecum and ascending colon Butlin gives an operative mortality of 29 from shock and sepsis, and 66 recoveries.

Excision of the cecum for malignant disease usually requires removal of the ileocecal juncture, which can readily be effected if the disease be not too far advanced. The arteries are almost all terminal, with but few anastomotic loops (Witherspoon), and the ligation of the blood-supply does not endanger contiguous portions of the bowel. A lateral incision is most convenient. The peritoneum along the outer wall of the cecum and ascending colon is divided, the malignant portion of the bowel raised, and the vessels ligated. The ascending colon is cut across, 1½ to 2 inches above the upper limits of the disease, and its distal end turned in by a purse-string suture. The proximal portion, clamped to prevent leakage, is lifted out of the abdomen, and when completely separated from its other attachments, the ileum is divided at a healthy point. The anastomosis is best effected end of the ileum to the side of the ascending colon. If the ileum cannot be readily brought to this portion of the colon, it can be attached to the transverse colon, either end to side or side to side.

The ultimate results of excision done early are good. In 14 cases Van Bramann had 4 without recurrence at the end of three years; Macewen 2 out of 5 cases, Wölfler 2 out of 12, Czerny 3 out of 18. When it is considered that a number of the remaining cases were free from recurrence less than three years, it is certain that later reports would increase the percentage of permanent cures.

We have excised the cecum 4 times—twice for malignant disease, once for tuberculosis, and once for chronic intussusception, all the patients recovering from the operation. In the past two years we have met with 5 cases of cancer of the cecum. In 2 extirpation of the ileocecal coil resulted in recovery, in 2 the extent of the disease prevented a radical operation and ileocolostomy was performed for relief, and in one advanced case without obstructive symptoms the exploratory incision was closed. A brief report of the 2 cases in which a radical operation was performed is appended herewith.

Case 1.—*Carcinoma of the Cecum Involving the Ileocecal Juncture. Extirpation. Recovery.*—J. E. R., American, thirty-eight years of age. Admitted to St. Mary's Hospital April 4, 1899. History of colicky pains in the abdomen for four years. While not severe, the pain has been persistent; during the past year it has become located in the right side. For four months a diarrhea has been persistent, and he has lost 40 pounds in weight. Family history negative.

Physical Examination.—A moderately emaciated man of cachectic appearance. No evidences of disease of organs outside of the abdomen. Temperature and pulse normal. There is considerable intestinal distention and intestinal peristalsis can be seen, accompanied by marked gurgling. On deep pressure in the right side an induration can be detected, evidently connected with the cecum. Indurated area is about the size of a small lemon, firm to the touch, and not very sensitive. Upon the history and physical signs the diagnosis of appendicitis seems warranted, probably tuberculous in origin, and the obstruction due to adhesions.

On April 6, 1899, a lateral incision revealed a nodular tumor of the cecum involving the appendix and ileocecal juncture. A few enlarged glands could be felt behind the bowel. An incision through the peritoneum was made on the outer side, and the cecum with the enlarged glands was lifted out of the abdomen. The vessels supplying the part were ligated with catgut. The ascending colon was divided 2½ inches from the tumor, and its distal end closed with a circular suture. The proximal end was clamped. The mesentery was progressively ligated, and the ileum divided 8 inches above the ileocecal valve. An attempt was made to join the end of the ileum to the side of the ascending colon, but there was some tension; the divided end was, therefore, turned in with a circular suture. The omentum was raised, and the side of the ileum 6 inches above its severed extremity was anastomosed to the transverse colon near the hepatic flexure with a Murphy button. A small drain was introduced into the right side, and the incision closed. Recovery was uneventful. The patient was discharged May 3, 1899. He rapidly regained his usual weight and strength, and is now pursuing his work in better health than for years before. Microscopic examination showed only inflammatory changes.

CASE 2.—*Carcinoma of the Cecum, Involving the Ileocecal Juncture. Extirpation. Recovery.*—A. C. S., Scandinavian, thirty years of age. By occupation a fisherman on the Mississippi River. Admitted to St. Mary's Hospital January 6, 1901, with the following history:

For the past six months has suffered from cramps in the abdomen, with a feeling of weakness. For the last three months the pain has been nearly constant in the right side. Loss of weight and strength; constipated. Family history good.

Physical Examination.—A man of good physique, somewhat emaciated, walks with the right thigh drawn up to relax the psoas and iliacus muscles. Temperature and pulse normal. No evidences of disease outside the abdomen. There is some tympanites. On deep pressure in the right side a small mass can be detected which is tender to the touch. A diagnosis of chronic appendicitis was made.

January 8, 1901, an intermuscular incision (McBurney) was made, and a tumor involving the cecum, appendix, and lower ileum was exposed. The incision was lengthened, cross cutting the deeper muscles. The peritoneum was divided outside, and the cecum, appendix, ascending colon, and 14 inches of the ileum were excised, a lateral anastomosis between the lower ileum and transverse colon being effected. There was extensive adhesion posteriorly in the mesentery, necessitating the extensive resection. A few small glands were found. A small drain was introduced, and the incision closed. Patient discharged February 27th in good condition. The microscopic examination of the glands removed showed only inflammatory changes.

In conclusion, I would urge that every surgeon, in operating upon these cases, should be prepared to excise the cecum. The early symptom may be such as to lead to the belief that an appendicitis exists, and in this way a timely operation for a malignant process may result in a complete cure.

CANCER OF THE LARGE BOWEL*

CHARLES H. MAYO

The surgery of today is the surgery of progress, and in no department is this more marked than in the operative work upon malignant conditions. To a great extent this has been due to a study of pathology in the living, as well as to a study of the anatomy and functions of the lymphatic system.

Statistics, as a rule, are dull propositions, but at times they present startling facts. Herman's collection of 20,544 cancer cases from the Prussian hospitals during 1895 and 1896 shows 10,537 as affecting the alimentary tract. There were 1706 in the intestine, 1204 in the rectum, and only 20 in the small bowel. Two hundred and fifty-five cases were not classified. As regards the sex, three times as many men were affected; the ages of the majority were between thirty and fifty years. In 1148 collected cases of cancer of the bowel Ewald found 874 in the rectum and 212 in the large bowel, including the cecum. In 112 collected autopsies of patients dying of cancer of the intestines Haussman found that 55 were limited to the gut; of the remainder, but 36 involved the lymphatic system, while 21 cases showed general infection.

Nothnagel says that carcinoma of the colon causes death in from six months to two years, but there are many cases which exceed this limit, Mikulicz showing several cases living two to four years after a simple colostomy, and says that the duration of life averages two years after the first serious symptoms. Allingham considers the removal of cancer in patients under forty-five years of age as unfavorable, between forty-five and sixty years as more

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* Reprinted from the "Medical Sentinel," Portland, Ore., 1904, vol. xii, p. 466.

favorable, and over sixty years still more hopeful in speaking of cancer of the rectum.

It has often been said that a man is as old as his arteries; the word vessels would represent the actual facts, as the term would then include the glandular and lymphatic systems, which in the young are in excess, gradually diminishing with age, until they are very deficient in the old from atrophic changes. Cancer in the young, then, is much more serious than in the old, both as to rapidity of growth and as to early involvement of the glands. The average life with cancer of the rectum is given at from one to two years; this may be true in the young, but in the old, if we approximate the commencement, it must often have been more than double that period. The statistics presented show the relative frequency of cancer of the bowel, and also one most important fact, that more than one-half of the deaths occur before the cancer involves the lymph-glands which drain the area involved. In other words, death occurs while the cancer is in a removable stage, and also when there is a possibility for permanent relief. With the exception of the alimentary canal, few cancers destroy life in their original location.

Cancer of the bowel usually occurs as cylindric carcinoma with glandular structure. Occasionally, medullary and scirrhous forms are found, although Maylard states that primary cancer of the intestine is always of the columnar-cell variety. Near the anus the squamous-cell type may be found. The lymph absorbents, being so much richer in the small bowel, they are affected earlier than in the large intestine, with its less glandular system.

A large number of cases of cancer of the large bowel develop obstruction as the first symptom of disease in an apparently otherwise healthy individual, while others give a history of repeated attacks of obstruction or ulceration, with or without hemorrhages. A tumor, while often sufficiently developed to be palpated, especially in the cecal region, may be so obscured by gas distention as to furnish no aid in diagnosis. Visible peristalsis, the abnormal contour of the abdomen, and, on rare occasions, inflation of the bowel, may also be of advantage in arriving at a diagnosis. Tumors of the rectum can usually be located by digital examination, at times aided by some form of specula.

In spite of the most careful examinations, combined with a history, the temperature, the pulse-rate, and the general appearance of the patient, it will often occur that only an approximate diagnosis can be made when the growth is above the rectum. Operations for the relief of obstruction of the bowels in adults will often disclose a cancerous condition of the intestine as its cause. We will find such a condition to occur 17½ times more frequently in the colon than in the small bowel, not considering cancer of the rectum, where it is relatively so frequent. A failure to diagnosticate cancer of the rectum is nearly always due to a failure to examine the local condition. In the ileocecal region it may be a difficult question to decide clinically between cancer, tuberculosis, and actinomycosis. When the ileo-intestinal coil is removed, the question of anastomosis is not one of ordinary intestinal union in which two parts of similar bowel are joined, but one in which, by reason of the dissimilarity, an anastomosis can be effected under very favorable circumstances.

In cancerous obstruction of either the large or the small bowel, the normal condition upon both sides of the diseased area is identical; but in this situation the fluid contents of the small intestine is emptied into the large bowel, which reduces it to solid feces by withdrawal of the fluids. The large bowel is essentially a dryer—an absorber of fluids through its vessel system. Removal of the large bowel increases fecal discharge fivefold, principally in fluids, while its loss only reduces the proteid absorption 10 per cent. The obstruction, when located in the ileocecum, can readily be relieved in joining the ileum with the transverse colon. The intestinal contents, being naturally fluid, do not endanger the anastomosis, as in the case of the union of the colon to colon with its solid accumulation. The size of the receiving intestine, and its nearness to the anal orifice, gives it all the advantage of an artificial anus on the surface of the body. The union can be effected at a point sufficiently high upon the ileum to secure healthy bowel for approximation. There is also the great advantage in that the communication is permanent. The extirpation, when performed later, if necessary, is more easily effected, both ends of the intestine being turned in and closed.

Exclusion of a portion of the intestine can be safely accomplished providing there is some exit for the secretions of the excluded part, but, as shown by the studies of Kammerer, if the exclusion is absolute, future trouble can be expected.

Resection of the cecum was first performed by Billroth in 1876. The operation has now been done many times, and a large number of cases have been reported. The operative mortality, as given by Greig Smith, was between 30 and 40 per cent. Furnival estimates the mortality of the more recent cases as somewhat less—20 to 25 per cent. perhaps. Butlin, in 95 reported cases involving the cecum and ascending colon, gives an operative mortality of 29 per cent. from shock and sepsis and 66 per cent. of recoveries.

Excision of the cecum for malignant disease usually requires removal of the ileocecal juncture, and if the disease is not too advanced, it can be readily effected. The arteries are almost all terminal, with but few anastomotic loops (Witherspoon), and the ligation of the blood-supply does not endanger contiguous portions of the bowel. A lateral incision is most convenient. The peritoneum along the outer wall of the cecum and ascending colon is divided, the malignant portion of the bowel raised, and the vessels ligated. The ascending colon is cut across, 1½ to 2 inches above the upper limits of the disease, and its distal end turned in by a purse-string suture. The proximal portion, clamped to prevent leakage, is lifted out of the abdomen, and when completely separated from its other attachments, the ileum is divided at a healthy point. The anastomosis is best effected end of the ileum to the side of the ascending colon. If the ileum cannot be readily brought to this portion of the colon, it can be attached to the transverse colon, either end to side or side to side.

The ultimate results of the excision done early are good. In 14 cases Van Bramann had 4 free of recurrence after three years; Macewen, 2 out of 5; Wölfler, 2 out of 12; Czerny, 3 out of 18 cases. When it is considered that a number of the remaining cases were free from recurrence, although less than three years, it is certain that later reports would increase the percentage of permanent cures.

When cancer involves the colon between the cecum and the rectum, a large majority of cases will require an exploratory incision to determine the exact nature of the affection, as well as its location. If cancer, the question will at once arise, is it possible to extirpate the growth? The question of removal will be decided by the extent of the invasion of the lymphatics or adjacent structures, also the age and general condition of the patient.

When possible, the diseased area is removed, and, according to conditions present, a colostomy is made, either temporary or permanent, or in some cases some form of immediate anastomosis is performed, either with or without the colostomy, which may often be necessary temporarily to relieve the ofttimes enormously distended and impacted condition of the intestines above the disease.

If the bowel is comparatively empty above, a suture anastomosis can be made, or some mechanical device employed for the purpose. It frequently becomes necessary, immediately after opening the abdomen, to relieve the gas distention by puncture of the bowel with a small trocar, and when filled with large quantities of fluid feces, a large trocar can be used for the purpose of facilitating the operative conditions.

In the removal of sections of the colon we can place considerable dependence upon the integrity of its blood-supply, which resembles in this respect the tolerance of the stomach.

After the removal of the growth, to accomplish the remainder of the operation with the least risk, the open ends of the bowel are sutured together for two-thirds of their circumference, exactly like an end-to-end anastomosis, the opposing sides of the bowel being also sutured together for 4 or 5 inches. A colostomy incision is now made at a favorable point, and the bowel union drawn into this incision and secured by sutures, the larger abdominal incision being closed. In a couple of weeks a pair of forceps are passed into the artificial anus, one blade into each portion of the bowel, and clamped together. The clamps are tightened each day for four or five days, until they cut their way through and reëstablish the lumen of the proximal and distal portions of the bowels. There is no danger of clamping the small intestine; the large bowel being sutured laterally, prevents their passing between the clamped portions of the bowel. The external fistulas can be closed at any time. We thus practically make an intra-abdominal intestinal anastomosis without an incision. We have employed this method three times, with perfect result. In case the two ends of the bowel cannot be brought together, we close the end of the distal portion by inversion and purse-string suture, then connect the proximal bowel to it with a suture or McGraw ligature, the proximal end of the bowel being brought through the abdominal wall to serve as a temporary anus until the anastomosis can be reëstablished, when it could be closed. This is not necessary when the bowels are comparatively empty, a long anastomosis by suture being quite a safe procedure. Mikulicz says he has greatly reduced his mortality in these cases by loosening the area of bowel involved, then lifting it out of the abdomen, and closing the abdomen to the bowel before resecting the intestine.

In case the tumor is not removable, the diseased area can be short-circuited by uniting the bowel above and below the obstruction. If the bowel is comparatively empty, suture anastomosis or the McGraw ligature is employed. Especially is the latter useful in cases with an excess of free peritoneal fluid, although any extensive operation in such cases is a questionable procedure in most instances, as the reparative powers of the peritoneum are so reduced. The anus is thoroughly dilated at the close of the operation, and a gas-tube inserted into the rectum.

Certain definite results are desired in operations upon cancer of the rectum, namely, permanent cure, low operative mortality, and a controllable anus or its best substitute.

The older methods of perineal operations, such as the circular enucleations of Lisfranc, the perineal excision, and Dieffenbach's anterior and posterior incisions, as well as Kocher's improved method, in which the coccyx was removed, are still employed. Many surgeons contend that these incisions permit of quite as thorough work as can be done when operating from below.

In operating upon rectal cancer in women additional space can be gained by the vaginal route, as advocated by Rehn, of Germany, Compenom, of France, and J. B. Murphy, in this country.

In prolapsing and invaginating cancers Steinthal made use of the elastic ligature, with good results. Kraske, in 1883, when assistant to Volkmann, noticed that opening the sacral canal was not of itself a dangerous procedure, and developed his sacral route for the excision of cancer of the rectum. Now nearly all methods performed by the sacral route bear his name, although modified by Bardenheuer and others—in being more extensive, by Heineke, Roux, and Rehn, in preserving the bone by temporary resection, and by Zuckerkandl in making a parasacral incision.

The difficulties which arose were from shock, which usually meant loss of blood; from peritonitis, as two-thirds of the Kraske operations necessitated opening the peritoneum, and from the attempts to perform radical operations upon inoperable cases, as the damage to the bone, loss of blood, and open peritoneum were necessary by this method before the operator knew fully the extent of the disease. The anus, which had been sacrificed in the earlier work, was now saved, when possible, but too often at the expense of imperfect removal of the disease.

Various methods of uniting the distal and proximal bowel were devised. Suture methods frequently failed or partially failed, leaving permanent fistulas, as did all methods much too often, were they plastics, Murphy button, or invagination. The Hochenegg method of invagination by passing the proximal end through the anus and suturing to the skin was later modified by removal of the mucous membrane of the anus. One of the best methods was to draw the proximal bowel through the anus, which was inverted, and make a circular suture union, which is replaced within the sphincter. Lang made a half-circular incision anterior to the anus, admitting of its being depressed two inches to reach the proximal end. With the anus saved, it was often found that the extensive mutilation had permanently injured its nerve-supply, and when saved intact, that it required the levator ani and internal sphincter to render it functionally perfect in preventing the sudden escape of gas and thin feces.

Gerster states that practically all these methods of union result in primary or secondary stricture. Frequently it was found that so much bowel had been removed that a sacral anus was necessary. When an artificial anus was determined on, Witzel, Wilms, and Rydygier recommended the division of the gluteus maximus, made at one side of the sacral incision, and the suture of the bowel end to the skin incision, thus gaining muscular compression. Gersuny rotated or twisted the bowel sufficiently to close the lumen and sutured; later he injected paraffin to produce closure by pressure. The incontinence which ensues is not comparable to those cases of torn or paralyzed sphincter or sacral fistula, as such cases still have the seventeenth-inch loop of sigmoid in the pelvis, whose value as a fecal container was pointed out by Wyeth, with the natural constriction at the top of the rectum to control the fecal current. Nonmalignant cases presenting themselves for relief are often considered improved by an inguinal colostomy. The local recurrence which is so frequent may cause such a degree of obstruction as to require a later colostomy, a condition which we met in three cases. The direct channel of the colon from the splenic flexure to the outlet leaves no space for a fecal container, and renders closure a question of hydrostatics in these operations.

The last decade has marked an advance in methods derived from an analysis of the mortality and failures in the past, and the gain has resulted in the present thoroughness in surgery, and the substitution of asepsis for antisepsis. The block removal of the rectum and glands, where possible from below, and in high location of cancer, the combined abdominal and perineal methods of removing rectum, glands, and all malignant tissue *en masse*, is the surgery for cancer of this region. This method is merely the application of principles of the surgery of cancer regardless of the location, as exemplified by Halsted's operation for the removal of cancer of the breast. It is probable that the removal of cancer of the rectum in the past compares well with the removal of cancer of the breast before the radical operations were made on the lymphatic system, with the exception of the former being in a more septic region. The combined abdominal and perineal method is now advocated for high rectal carcinoma by the pioneers in rectal surgery, Kocher, Kraske, Gaudier, Quénu, Trendelenburg, Abbe, Weir, and numerous others.

Statistics change from year to year with the ability of the operator, whose judgment increases through his mistakes and failures, and whose ability to select a justifiable operation for rectal cancer, according to the extent, location, fixation, glandular involvement, cachexia, and age, or invasion of the neighboring organs, such as vagina, uterus, prostate, or bladder, becomes more and more reliable. Therefore statistics mean more to the surgeon who makes them than to any one else. Kraske's mortality in the first 10 cases was 40 per cent.; this he later reduced to less than 10 per cent. The average mortality is still somewhere between 15 and 18 per cent. Hochenegg, in 121 sacral operations, had 5 per cent. more mortality and 25 per cent. cures.

Krönlein answers three questions: Mortality of operation, recurrence, and functional disability. One hundred and eighty-one cases show that the sovereign method is extirpation; 80 per cent. survive, 14 per cent. are lasting. Statistics today are more favorable.

The functional result is best when possible to preserve the anus and sphincter. In the discussion, Kraske expressed satisfaction in his 120 cases of sacral method, but thought the combined abdominal and sacral method more radical.

Our usual method of performing the combined operation is with the patient in the Trendelenburg position. Through a median abdominal incision the bowels are pushed into the upper abdomen, where they are retained by a gauze pack. A careful examination of the upper rectum, sigmoid, and lymph-glands is now made, and at times the liver region is also explored, to determine the question whether the operation is to be palliative or an attempt is to be made to secure a permanent cure.

If total extirpation is decided upon, a horseshoe incision of the peritoneum is made, cutting on each side of the rectum and across it below. With dry gauze the fatty tissue of the short mesentery is separated, and the lower sigmoid loosened by blunt dissection.

The bowel is now clamped as low as possible, but at least two inches above the cancer, by two pairs of heavy forceps placed close together. The bowel is severed between them; one cut end of the bowel and forceps is protected by gauze; the other end of the bowel is turned in and closed with a purse-string suture, done with the other end, which has been covered with the gauze. With both ends closed there is no danger of soiling the peritoneum in the further steps of the operation.

The superior hemorrhoidal artery is ligated, and the proximal sigmoid segment is separated sufficiently to be brought through a McBurney gridiron incision in the iliac fossa. This incision is peculiar in the skin incision, being at a distance of one and one-half inches to one side of the muscle separation. The end of the bowel is brought out and sutured to the skin incision; also a few sutures unite the bowel to the peritoneum at the point of exit. This preserves the loop of the bowel and abdominal wall from within; the muscle separation and the sigmoid curve of outlet, with the skin covering for compression, gives a fairly controllable anus at a position where the patient is enabled to give it proper attention.

The distal bowel is now separated and pushed below the uterus and bladder or the bladder and prostate. A gauze pack is placed over this, and the peritoneum nearly closed, forming a pelvic floor, and the abdominal wound is closed, the remainder of the operation being completed from below. A gauze pack is placed in the rectum, to render it palpable, and the anus closed by a purse-string suture. An incision is made around the anus, and separation of the rectum is made until the point is reached where it was loosened from above. All the glands and fascia in front of the coccyx and sacrum are removed at the same time. A portion of the pack previously placed in the pelvis is now withdrawn through the perineal wound for drainage, the remainder of the incision being closed. If the surgeon has a good assistant, the perineal operation, with the removal of the rectum, can be performed by him during the time the abdominal work is advancing above. If the median incision discloses an inoperable condition, that is, inoperable from a curative standpoint, by reason of extensive metastasis in glands or neighboring organ involvement, an inguinal colostomy is made and the median wound closed.

Colostomy, as usually performed, has been the lifting of a loop of sigmoid through an abdominal iliac incision. The loop is supported by one of the various methods, and the bowel is sutured to the peritoneum and skin, forming a true funnel-shaped hernial opening into the abdominal wall; that is, skin and peritoneum in contact. There was often prolapse following operation, to avoid which the loop of a sigmoid was caught up at such a point as to render the descending colon under slight tension in the wound, thus rendering the closure of the outlet a question of pressure against a descending flow. We like best the operation of Mixter, in which the sigmoid loop is drawn through a McBurney gridiron incision, and a rectangular skin-flap is lifted from one side the incision, attached to one end, and drawn through an opening in the sigmoid mesentery. The skin-flap is sutured back to place at the free end, and sutures applied to the bowel, peritoneum, and skin. When the loop of bowel is cut through, this skin covering of the proximal end acts as a valve when compressed by a pad, very effectually controlling the outlet.

A CASE OF VAGINAL ANUS, THE RESULT OF A HYSTERECTOMY, CURED BY ILEO-COLOSTOMY*

WILLIAM J. MAYO

Mrs. A. J., aged forty-two years, Dane, was admitted to St. Mary's Hospital March 18, 1897, with the following history: She is the mother of four children, the youngest eleven years of age. Since the birth of this child she has suffered from some pelvic trouble more or less constantly. For the past six months this difficulty has been accompanied by pain and swelling in the lower abdomen, and has caused chills, fever, and great loss of flesh. For five years she has had a chronic cough, expectorating freely at times. There is a tendency to diarrhea. Menstruation has been irregular and painful.

Examination.—Temperature, $102\frac{2}{5}°$ F.; pulse, 116; tongue red and somewhat glazed; heart normal. Consolidation in the apex of the right lung. Sputum contained tubercle bacilli. There was a small amount of albumin in the urine; no casts. Blood examination showed leukocytosis. Uterus was fixed by a mass in each side, evidently due to suppuration in tubes and ovaries.

Considering the amount of pulmonary involvement and the condition of the patient, radical operation upon the pelvic suppuration was considered inadvisable, and for immediate relief vaginal section and drainage of the pus-collections were thought best.

March 20, 1897, the patient was put on the table and anesthetized. During the preliminary cleansing it was noticed that pus was exuding from the rectum, and upon examination the mass on the right was found to be decidedly smaller. It was evident that an abscess had opened into the bowel, and as this relieved the present necessity, she was returned to bed without operation. For a few days the symptoms improved, but soon returned with increased severity.

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*Reprinted from "Annals of Surgery," November, 1897.

Observation showed that the abscess cavity discharged intermittently into the bowel, and that the drainage was ineffectual. The mass in the left side remained about the same.

April 4th the uterus was removed by the vagina, the pus-pockets being opened and drained. On the third day the lower bowel acted freely by enemata. On the fourth day thin liquid feces from the small bowel began to discharge from the vagina. The constant escape of small bowel contents excoriated the buttocks and thighs of the patient, while a progressive loss of strength, from the rapidity with which food passed through the alimentary canal, was immediately manifest.

The abdomen became quite flat, the temperature subnormal, and the condition of ammoniemia, described by Roswell Park as due to the development of ammonia compounds, was marked. Examination by vagina showed a large opening involving more than one-half of the circumference of the small bowel. The rectum was nearly occluded by the pelvic exudate.

On May 1st the abdomen was opened in the midline. The lower ileum, about 8 inches from the cecum, was found to be the seat of the anus. The remains of the pelvic inflammation bound the cecum and upper rectum into the mass. The ileum was divided 10 inches above the vaginal anus, the distal end turned in and closed.

The proximal point of division proved to be too short for easy attachment to the transverse colon, and was, therefore, fastened by a Murphy button to the sigmoid, which was unusually well developed.

As the pressure against the rectum by the inflammatory products below might prove a sufficient obstacle to the fecal current to direct the stream backward and so around to the vaginal opening, Dawbarn's method of passing a purse-string of silk about the colon, 3 inches above the anastomosis, and tie sufficiently tight to interrupt the fecal passage, yet not to interfere with the circulation, was carried out. After the operation the bowels acted twice daily, and no further discharge took place from the vagina, except a moderate amount of mucus from the unused intestinal tract. Patient was discharged June 3, 1897, and, with the exception of the lungs, was in fair condition.

It is probable that the original infection in this case was tuberculous, the lung involvement was secondary, and that a mixed infection of the pelvic focus of more recent date determined the more rapid development of the pelvic symptoms.

The spontaneous rupture of pelvic abscesses into the bowel often results in cure, but too frequently the drainage is ineffectual, and the patient becomes worn out by exhausting discharges.

In the experience of the writer, in four previous cases in which this condition existed, vaginal hysterectomy had proved curative. Boldt and others have advocated a similar plan of attack. The unfortunate result in the present instance was probably due to the tuberculous element. The frequency with which operations upon tuberculous disease of the ovaries and tubes result in primary or secondary fecal fistula is known. In the exhausted condition of the patient, attempt at direct operative relief by suture of the bowel defect through the abdomen would probably have resulted in failure.

Intestinal anastomosis by the Murphy button has a great advantage over other methods if the peritoneum is intact, and this is essential to the use of the button. Suture operations are of greater value when the state of the peritoneum would render rapid formation of adhesions uncertain, as the pressure necrosis of the button does not give time for primary union of tissues other than peritoneal. My own experience with 17 button operations of all varieties leads me to believe that in properly selected cases Murphy's device has great merit. The method of Dawbarn, described on page 476 in "Annals of Surgery," April, 1897, is a rapid and easy way of obstructing the fecal current, and is a credit to its originator. Eighteen inches of the ileum, the cecum, ascending, transverse, and descending colon, are, of course, thrown completely out of use in this case, but the vaginal opening permits of the escape of the very moderate amount of intestinal secretion which might otherwise accumulate.

SOME REMARKS ON INGUINAL COLOSTOMY*

WILLIAM J. MAYO

Several years ago I received a marked copy of a newspaper printed in a neighboring State in which it said, in substance, that Mr. —— had just died in great misery as the result of an unnecessary operation performed upon him in the hospital with which I am associated. I recollected the case well. The man had an inoperable carcinoma of the rectum. I made an inguinal colostomy as a palliation, and he lived about four months after leaving my care. At the time the article seemed to me wholly malicious, but upon reflection I am not sure that it was entirely unjust. The operation certainly did not cause his subsequent suffering, but was the temporary relief obtained sufficient to warrant the pain of an operation, the expense incurred, and the separation from his family during several weeks? It is an open question.

Ten years ago excision of the rectum was in great disfavor; the immediate mortality was high, the percentage of permanent cures near the vanishing point. Colostomy gave relief in cases in which obstruction was a prominent symptom, and was deservedly popular. The ease of performance and the small mortality of the operation itself led to its indiscriminate employment, merely because the patient had a cancer of the rectum. It has been claimed that by deflecting the fecal movements and giving the rectum absolute rest partial atrophy of the unused portion of the bowel is one result, and that the diminished blood-supply and avoidance of irritation checked the growth of the malignant process or greatly retarded its progress, and experience has shown that to a certain extent this is true. It should not be forgotten, however, that carcinoma of the upper rectum is often, if not usually, a slow process, and much of the supposed prolongation of life is but the natural evolution of the disease. High carcinoma of the rectum, in my experience, is not infrequently found in the comparatively young. I had one patient fourteen years of age and several were under thirty. Vast improvement in the results of excision of the rectum followed the impetus given this operation by Kraske, although there is a great tendency to radical departures from the technic he popularized. The results, both immediate and remote, of radical operations in this locality are relatively good, and compare favorably with those for carcinoma of the breast or uterus.

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*Reprinted from "American Medicine," April, 1901.

This procedure removes a large number of cases from the list in which colostomy has been the resource. In advanced cases without obstruction this operation is not indicated, and surgery is discredited by its performance, but in selected cases colostomy is of great benefit to the victims of hopeless disease.

In making a permanent artificial anus, the suggestion of Wyeth is of great importance, that all the movable sigmoid should be pushed upward, making the opening as near the rectum as possible. The sigmoid flexure of the colon is the natural reservoir of fecal accumulation, and by placing it to the proximal side, the ability to retain the feces is much better than after the method of Allingham and Cripps, in which, to prevent prolapse of the mucous membrane of the upper colon, it is advised that as much of the bowel as will readily pass to the distal side of the artificial anus should be so placed. The formation of a spur is best accomplished by suturing the proximal and distal limbs of the colon to each other, and the advice of Kelsey is sound that the margins of the incision be well fastened to the colon, to prevent wound separation under sudden strain. Kelsey had 2 cases in which the small bowel escaped alongside of the colon during a fit of sneezing or coughing twenty-four to forty-eight hours after operation.

The most annoying feature of the average artificial anus is the difficulty of controlling the escape of feces and gas at inopportune times. Bailey suggested and carried out a plan for colostomy on the principle of the gastrostomy of Ssabanajew-Frank. This operation is especially recommended by Tuttle. An intermuscular separation of the usual colostomy incision is made, through which the loop of sigmoid is drawn out and a spur formed. The knuckle of bowel is firmly anchored in the deeper wound, with sufficient projection of the apex to enable the anus to be formed at a separate skin incision, 2 inches below, in the direction of the internal ring. The superficial incision at the point of egress of the bowel from the abdominal cavity is now closed. The loop of colon lying between the skin and muscular wall of the abdomen is easily compressed against the firm aponeurosis of the external oblique muscle by an elastic truss with a water-pad. The appendices epiploicæ, which may be exposed on the open surface of the bowel, should be ligated at their base and cut away, as they slough and separate slowly, adding considerable unnecessary odor. The exposed bowel should be covered with some protective dressing, such as rubber tissue, to prevent the granulations which firmly unite the gauze to the colon and cause great difficulty in getting it loose. Witzel makes colostomy after the same general plan as Bailey's, except that the colon is divided and the distal end inverted and permanently closed, the proximal end being carried over the iliac crest. It sometimes happens that the mesentery of the sigmoid is too short to allow its being sufficiently drawn forth for the formation of the colostomy as described. Under such circumstances the operation of Maydl will usually be fairly satisfactory. Greig Smith endeavored to obtain better muscular control by separation of the muscular layers in their natural lines, and not suturing the parietal peritoneum to the skin, as has been so commonly practised, allowing the knuckles of colon to become attached directly to the muscle-fibers. I have found this advice excellent. To those interested in the subject of artificial anus the article on the subject written by Weir* will be of great value.

Colostomy as a preliminary step to excision of the rectum has been largely practised, but as the newer operations almost invariably permit a restoration of the continuity of the bowel, the danger of wound infection from fecal contamination is greatly reduced, and since it requires an independent operation for its performance, as well as closure, it is probable that the combined risks are greater than a well-planned complete primary excision. If a preliminary colostomy is made, it should be located as high on the bowel-wall as possible, giving the greatest amount of sigmoid below the artificial anus for future manipulation during the excision. As a preliminary step to extirpation of rectal carcinoma in 4 cases I made a colostomy. My first case was lost as a result of tension on the sigmoid causing gangrene. The artificial anus firmly anchored the colon, and after the resection of the rectum there was not enough sigmoid to reach to the proper site of attachment without undue strain.

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* "Medical Record," April 21, 1900.

While the field of colostomy has become greatly narrowed in malignant disease, for non-malignant affections of the rectum it has an increasing usefulness. Tuberculous and other forms of ulceration of the rectum which are essentially chronic or incurable in their nature, as well as some non-malignant strictures, are best treated by temporary or permanent artificial anus. In deciding upon colostomy, it should be ascertained, if possible beforehand, that the diseased condition does not extend above the point at which the artificial anus is to be situated. Some six years ago I had a case of multiple polypi of the rectum. There were profuse and foul-smelling discharges of mucus, pus, and blood. The man was in miserable condition. It was thought, after such examination as could be made, that the disease was confined to the rectum. A left inguinal colostomy was performed, with a result of greatly aggravating his already deplorable condition. Before the operation he was able to control his discharges, but nothing would prevent their escape from the artificial anus, and he became a burden to himself and every one with whom he was brought in contact, and later the opening was closed by another surgeon. I have since encountered 4 of these cases of multiple rectal polypi, and have been able to satisfy myself that the disease extended throughout the entire colon, as in the above unfortunate experience. In doubtful cases since that time I have exposed the sigmoid in the inguinal region before doing a colostomy, to make sure that such an opening would be above the seat of disease. In this way the lumen of the bowel can be explored in the same manner as the rectum, and in two instances I found the disease had extended to a point above the proposed site of the colostomy, thus rendering the intended operation useless. A few sutures safely close the exploratory incision in the bowel itself.

From my own experience I would urge that this exploration be done more frequently. The point of exploration need not necessarily correspond with the intended artificial anus, and if desired, the delay in the opening of the colon to secure safe adhesions may be postponed a few days, without regard to the sutured intestinal opening. I will merely call attention to right-sided colostomy for the relief of chronic diseases of the entire colon. Temporary right artificial anus has been performed by Barbat and Sullivan for the cure of amebic dysentery. Keith recommended and carried out this procedure for the cure of chronic membranous colitis. White and Golding-Bird, Lawrie, and others also report cures of this troublesome form of colitis in a similar manner. Right-sided colostomy does not offer the mechanical conditions requisite for a satisfactory anus; the discharges are more liquid, and the inability to lift the ascending colon out of the wound precludes the possibility of an adequate spur or perfect control. However, as the pathologic conditions calling for right-sided colostomy are in themselves so serious a disability, the relief from pain and the prospects of cure may compensate for the annoyance. For temporary purposes the colon should be opened longitudinally and the retraction will usually be sufficient to enable one to close the opening by an incision about the margin of the artificial anus. After trimming away the skin, a few provisional sutures will prevent leakage during the further steps of the operation, which is completed by opening into the free peritoneal cavity, loosening up the sigmoid, and with a second row of sutures turning in the first row.

On a recent visit to Krause's clinic at the Altona General Hospital, Germany, he exhibited several cases in which he had passed a specially devised clamp, one jaw into each limb of the open lumen of the bowel, and by slowly closing the instrument the opposing surfaces were compressed, and by necrosis a communication between was established. The instrument was made of aluminum, to prevent weight-pressure of the handles on the wound, and was left in position a week. The external opening closed spontaneously after the anastomosis was established. The instrument is so constructed as to exert its pressure at a point beginning 2 inches below the external opening, and the communication established is 2½ inches long by ¾ inch wide. In elderly or debilitated subjects this contrivance, to avoid the necessity of a secondary operation, might be of value. I brought one of the instruments home with me, but have hesitated to use it. Krause's results were good, but the essential principle is the same as the old and rightly abandoned operation of Dupuytren.

In conclusion it may be said:

(1) Colostomy is not now a rival of excision of the rectum for malignant disease, and should be employed only in hopeless cases presenting obstructive phenomena.

(2) For a permanent colostomy, the combination of Wyeth and Bailey's methods gives a satisfactory result.

(3) Colostomy preliminary to excision of the rectum should be located high on the colon to give sufficient length of sigmoid to permit restoration of the continuity of the bowel.

(4) For ulceration and other conditions in which the upper limit of the disease is not definitely known the interior of the bowel should be explored through the inguinal incision, in order to determine the proper site of the opening.

(5) Right-sided colostomy has an increasing field of usefulness, *e. g.*, in amebic dysentery, chronic colitis, etc.

SIGMOID AND RECTUM

OBSERVATIONS ON THE SURGICAL TREATMENT OF DISEASES OF THE RECTUM*

W. W. AND W. J. MAYO

The two principal requirements physicians must meet in the surgical treatment of diseases of the rectum are: (1) That the cure shall be permanent, with the least pain possible; (2) that the time lost from business shall be reduced to a minimum.

We have tried various methods of treatment of rectal diseases, and will attempt to demonstrate those which have been most successful and satisfactory, considered from the standpoint of the patient as well as the physician.

We have not found specula, as a means of diagnosis and treatment, of general use, and seldom make a diagnosis with one when we fail to make it digitally. With scarcely an exception the bivalve and trivalve specula partially obscure the lower 1½ inches of the rectum, wherein most of our work must be done. Their use is often painful, and frequently alarms the patient unnecessarily, so that, unless required by peculiarities of the case, we do not make routine use of them. Our preference is for the retractor, made on the principle of Sims' vaginal speculum. A cylindric speculum which allows a view of the rectal walls as it is gradually withdrawn is often of service; and the Allingham plug speculum also has its value in proper cases.

The use of measures to relieve pain is important. In operations requiring much time, ether is always used; cocain applied externally has little effect. The pain of hypodermic injection is complained of unless the needle be very fine, and the drug frequently appears to cause faintness. It is of most benefit in the incision or excision of external piles. In the majority of these minor operations it is our custom to give our patient a couple of ounces of slightly diluted brandy, the reflex action in a temperate person being sufficient to benumb sensibility for a short time.

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*Reprinted from "Trans. Minn. State Med. Society," 1887, pp. 81–89.

External hemorrhoids, resembling tag-like tumors, when not inflamed, are satisfactorily removed with scissors. If inflamed and containing a clot, they are incised, and after contraction has taken place the remaining tags are excised. In the large edematous or doughy tumors, covered entirely or nearly so with skin, and varying in size from a hazelnut to a walnut, the hypodermic injection of a few drops of a 50 per cent. solution of carbolic-acid crystals into the center of each pile will generally cause a rapid shrinkage in the course of a fortnight, and by removing the remains with scissors, the cure is made permanent. Herein may lie the cause of the more frequent return of hemorrhoids than by other methods of treatment. Unless sufficient acid is used to cause the entire removal by slough, the remaining tag, in both internal and external piles, is the point of least resistance to those bodily habits which are active in their production.

We now limit the use of the injection method to the least vascular of the hemorrhoidal tumors. As a rule, the ligature is most satisfactory and least painful, though frequently a cause of vesical irritability.

To those cases presenting the small red, wart-like piles, which though in size insignificant in effect are the cause of much suffering, the application of fuming nitric acid is of immediate relief. The usual history of prolapse with stool or bleeding in these cases is absent, and the proper diagnosis and treatment depend almost entirely upon digital exploration and the careful use of the speculum, which is absolutely necessary in the treatment. The ligature is difficult of application, as the tumor is too small to be protruded by straining, and on account of its thin covering and vascular nature, will tear and obscure the field with blood if an attempt is made to pull it down. In these cases injection has proved disastrous, causing intense turgescence and inflammation of the neighboring veins and tissues, and frequently setting up a difficulty from which the patient will not recover in weeks. The large tumors of this variety should be thoroughly crushed with heavy forceps and nitric acid applied to the stumps.

Many of these tumors, if thoroughly crushed and twisted, require no further treatment, while a minimum amount of discomfort is experienced afterward. The after-treatment of the majority of cases consists in the production, daily, of softened fecal evacuations. Equal parts of sulphur, calcined magnesia, and sugar is the laxative ordinarily employed for this purpose; this is given in tablespoonful doses in milk at bedtime. When several large tumors have been ligated, which would prolapse with stool, the constipation plan is necessary, and when desirable to unload the bowels, if an enema of two ounces of sweet oil be given some hours before the laxative, the hemorrhoids will be readily ejected. If irritability of the bladder or rectal tenesmus follows operation, hot sitz-baths with suppositories of opium and belladonna are efficacious.

A word in regard to stretching the anus. A few years ago it was recommended in almost all rectal diseases. As routine treatment it is barbarous, but if there is spasmodic contraction of the anal muscles, with or without fissure or hemorrhoids, this of itself may cure, if thoroughly performed by grasping the tuberosity of the ischium of each side with the fingers and stretching with the thumbs until muscular resistance ceases so completely that power of contraction is not regained for some days,

We have met with a few cases of obstinate dysenteric discharges from the rectum, caused by small ulcerations in its lower portions. The application of nitric acid was followed quickly by a cure.

We have been so well satisfied in treating fistula by incision and packing iodoform gauze that we have tried no other plan. In a recent case of supposed fistula, with the external opening in the median line posteriorly, no internal opening could be found. On careful exploration it proved to be a sinus leading to a suppurating dermoid cyst, containing a bunch of hair several inches in length. Posterior linear rectotomy was performed in one case for stricture and fistula, the incision extending from the internal sphincter to the coccyx. This incision did not heal as expected,—it being impossible to keep the patient quiet,—and eventually cicatrized without union. It was intended to freshen the surfaces and suture after the method for complete laceration of the perineum, but as the internal sphincter was capable of retaining feces, the patient was little inconvenienced, and, as he was relieved of his former difficulty, he objected to the operation and it was not undertaken.

We have operated upon three cases of cancer of the rectum. The first, an epithelioma involving the tissues of the anus, was excised with a portion of the rectum. There was return of the disease in a few months. The second was too high for accurate location, and caused complete obstruction. An artificial anus was formed by lumbar colotomy, and gave much comfort during the remainder of life. The third consisted of a scirrhus the size of an orange, located two inches above the anus, on the posterior rectal wall. A vaginal speculum was introduced into the rectum, in such a manner as to cause the growth to project between the small valves. The tumor was then thoroughly scooped out with a sharp spoon. Great relief was afforded for several months from the pain on defecation and the irritating discharges. This relief would have been more prolonged by colotomy, and in a similar case, where total extirpation is out of the question, we would give preference to this operation.

Before closing we wish to call attention to a common and most provoking malady, both to the physician and to the patient—itching anus.

In our experience the cause of the majority of cases is an irritating discharge from the rectum, and permanent relief depends upon the cure of this condition. We have often found this to be a rectal catarrh from an ulcer, ascarides, or an undiscovered internal hemorrhoid of itself causing no annoyance; but in many cases no cause can be found, or the cure of a supposed cause does not relieve. In a chronic case the appearance is typical; the skin is of a light color, greatly thickened and corrugated, the folds extending into the anus and the bottom of each sulcus fissured or ulcerated. These cases are usually benefited by the following plan of treatment: The skin is put upon the stretch, and nitric acid is applied to the ulcerated furrows. To prevent scratching at night a mixture of oil of peppermint one part and olive oil two parts is applied upon a pledget of cotton; or in place of this extract of belladonna may be smeared over the surface and a dram of vaselin pushed into the rectum.

Should this fail, a hot hip-bath is ordered at bedtime and a lotion of corrosive sublimate or Goulard's liquor applied; occasionally a grain of cyanid of potassium to an ounce of vaselin has a remarkable effect. Should the catarrhal discharge from the rectum be excessive, a suppository of iodoform and tannin may be introduced to render the discharge more bland. In all cases enough of the sulphur and magnesia mixture is given to insure a soft stool.

REPORT OF A CASE OF VOLVULUS OF THE SIGMOID FLEXURE OF THE COLON SUCCESSFULLY REDUCED AFTER ABDOMINAL SECTION*

WILLIAM J. MAYO

Mrs. M., aged fifty years, an inmate of the Second Hospital for the Insane, Rochester, Minnesota, suffering from chronic mania.

History.—Like most insane patients, she was chronically constipated, but was otherwise in good health until April 1, 1893, when she was seized suddenly with vomiting and symptoms of acute obstruction of the bowels, which grew worse in spite of treatment. She became tympanitic, with quick pulse and moderate elevation of temperature. On the evening of the third day, April 3, 1893, I was called in consultation with a view to operative interference. I found her lying in bed with her knees drawn up, her face pinched, and expression anxious. Pulse, 114, and temperature, 100° F. Abdomen exceedingly distended, especially in the center, where there was a peculiar ovoid enlargement of great size. A little chloroform was administered, and the left hand was introduced into the rectum. With my left index-finger a tight constriction was found at a depth of about 8 inches, just to the left of the sacral prominence. A few hours later, after the usual preparation, and under ether anesthesia, a fine incision was made in the linea alba below the umbilicus, and a huge distended viscus at once presented. Its size was so great that at first it was thought to be the greatly distended stomach, but was recognized as the colon by its glandulæ epiploicæ and longitudinal bands. An incision was made into it, and a large quantity of gas and some fluids evacuated, sufficient to relieve the distention, and allow careful examination, which showed one complete turn of the sigmoid upon itself, from left to right, and a crowding of a considerable portion of the transverse colon into the right pelvic region. The balance of the colon and small intestines were but moderately distended. The confined

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* Reprinted from the "Annals of Surgery," 1893, vol. xviii, pp. 28, 29.

part of the sigmoid flexure furnished the greater part of the abdominal distention, and was dark and congested. A few Lembert sutures closed the incised bowel, and reduction with replacement was accomplished with moderate difficulty. As soon as the patient had recovered from the anesthetic 10 grains of calomel were administered. This was followed in a few hours by profuse discharge from the bowels and an uneventful recovery.

The comparative rarity of this form of obstruction, its typical history, and the complete reduction render the case of interest. In the larger number of cases reported by Treves and Greig Smith reduction was not possible.

RECTAL PROLAPSE*

CHARLES H. MAYO

Prolapse of the rectum is not a common malady. In children it usually follows an attack of either diarrhea or constipation, and is often characterized by invagination from the sulcus so frequently found between the anus and outer fold of the prolapse. The somewhat straighter line of the sacrum and lessened curve of the rectum tend to favor the condition. In these cases cure is usually accomplished by rest in bed and adhesive strapping of the buttocks. The supports are temporarily removed for defecation, which is accomplished in the recumbent position, aided by cold-water enemata. Linear scarification may be necessary in obstinate cases, and sometimes acid applications are employed.

Rectal prolapse in adults is a very serious condition. The term anal prolapse is usually limited to those cases which have a prolapse of mucous membrane only, with projecting fold of about an inch in length. The rectum has a normal range of movement to accomplish its functions. Its position is maintained by perirectal tissue, fascia, sphincter muscles, the levator ani, and rectococcygei muscles. The relaxation or giving way of these supports tends to permit prolapse.

The adult prolapsus recti is composed of all the coats of the bowel, with a projection from 3 to 8 inches from the anal ring, the diameter of the mass being from 3 to 5 inches. The projecting mass is continuous with the skin at the anus, and the outer layer does not pass within the anal ring, showing that it is not an invagination. The sphincter ani is so dilated that it lacks all power to aid in the retention of the bowel. These patients describe the condition of the sphincter as being normal previous to the beginning of the disease, and after operation relieving the condition, the tone of the sphincter gradually returns, which would tend to prove that relaxation of the sphincter is secondary and has but little to do with causing the prolapse.

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*Reprinted from "Trans. Minn. State Med. Society," 1901, pp. 147–151.

From the abdominal side it is noted that the peritoneal fold of the floor of the pelvis is extremely loose, and during the condition of prolapse this peritoneal fold extends completely outside of the body into the mass, constituting a hernial sac surrounding all but the posterior portion of the rectum. It is possible, therefore, although rare, to have a hernia in the tumor.

The methods of cure have been numerous, which is an indication of the extreme intractability of the condition. Some of them may be enumerated as follows: From below, by linear scarification; the application of acid; excision of a wedge of bowel and sphincter; excision of protruding mass; posterior attachment of bowel near the coccyx, and the wearing of mechanical support. From above, artificial inguinal anus; suture of the bowel to the parietal peritoneum; suture of folds of mesentery to mesentery; folding the lumen of the bowel into itself longitudinally, and, last, the method which I wish to add, restoration of the peritoneal floor of the pelvis.

Linear cauterization, as advocated by Van Buren, has had an extensive application, and for the less severe cases of prolapse has been fairly successful. The knife-edge of a Paquelin cautery is employed to make from 4 to 6 three-inch burns parallel with the bowel, but not through the mucous membrane. The cuts penetrate the external sphincter. The result is a contraction and increased rigidity of the bowel and sphincter. Nitric acid or the acid nitrate of mercury is occasionally employed in chosen cases. Under an anesthetic the bowel is dried, and the acid well rubbed into the exposed mucous membrane and rapidly washed off. The method may need repeating, but frequently proves adequate.

Verneuil and numerous others have anchored the rectum, the rectopexy being by a posterior incision from the anus to the coccyx, the bowel not being opened. Mikulicz has advocated amputation of the mass as a method of cure. A circular incision is made through the outer fold of the prolapse near the anus, and is of sufficient depth to expose the peritoneum, which is completely closed by a running suture; the amputation is completed through the inner fold, and the mucous membranes coaptated by suture. There are many slight modifications of this procedure. Ray makes the same incisions, but carefully peels back the peritoneal fold, ligating it as a hernial sac, and suturing the mucous incisions. George R. Fowler makes about the same anterior incision, leaving a short cuff of mucous membrane. A short incision is made clear through both walls of the prolapse, and a suture passed on the proximal side of the incision. The suture line is continued entirely around the prolapse. The incision is increased only after each suture is passed, thus making a bloodless amputation, the cuff of mucous membrane covering the suture line. These operations involve, from anatomic conditions, considerable secondary risk from infection.

The excision of a wedge of both sphincter and prolapse was frequently employed a few years since. Various apparatus have been devised to support the anus, thus preventing the prolapse. The more common are soft-rubber balls, water-pads, and various truss appliances, which are of but little service.

A considerable number of cases have been reported in which inguinal colostomy was made to relieve the difficulty, after the method of Jeannel's colopexia. This is rarely employed now, yet it is an indication of the sufferings of these patients. Anchoring the bowel above in some manner without opening the bowel is at present growing in favor. Noble sutured to the rectus, but the usual method is to suture to the internal oblique by means of a McBurney gridiron incision. The sutures are of slow-absorbing or permanent material, from ½ to 3 inches of bowel being attached. F. W. Parham reports one case of peritoneal suture of the lower sigmoid in a person who was able to produce or reduce his prolapse by voluntary effort, the latter being a rare attainment. George A. Peters has devised an operation which proved very successful in two cases—one a child, the other an adult. Through a median abdominal incision the anterior wall of the rectum is folded into itself by suture, practically forming two tubes, the posterior being the mucous, the anterior being peritoneal, projecting into the lumen of the bowel. The sutures are interrupted, and commenced as low as can be reached. This narrows and stiffens the rectal wall for a space of 3 or 4 inches. In the child the same sutures were also attached to the parietal peritoneum and abdominal wall. The latter attachment was not made in the adult case.

The method which we have found serviceable in two cases has been to restore the rectovesical floor in the male, or Douglas' pouch in the female. It is this fold that must form the hernial sac in the prolapse, and is always found so relaxed in these cases. The operation and plan were based upon an earlier operation done after Peters' method, which also proved successful, so far as known.

Normally, the distance from the anus to the peritoneal fold is about 3½ inches in the male and 2½ in the female. The peritoneal fold in the floor of the pelvis is shaped much like a horseshoe. The posterior layer covers the anterior and lateral walls of the rectum, then laterally it lines the walls of the pelvis, and it passes anteriorly up over the uterus in the female and the bladder in the male. The peritoneum enfolds the bowel at the level of the third sacral vertebra, forming a true mesentery.

By applying numerous sutures of silk or Pagenstecher's linen to obliterate the peritoneal fold, catching deeply into the peritoneum in making the folding, and, when convenient, catching the front or side wall of the rectal curve as the suture line rises out of the lower pelvis, a firm support is built in the pelvis, from 3 to 5 inches in extent, surrounding and attached to the prolapsing bowel. The sigmoid is dropped over the line of sutures in the new pelvic floor as a protection to the sutured surface.

After any radical cure of prolapse, rest in bed for at least three weeks is advisable.

EVOLUTION IN THE TREATMENT OF CANCER OF THE RECTUM*

CHARLES H. MAYO

Certain definite results are desired in operating on cancer of the rectum, namely, permanent cure, low operative mortality, and a controllable anus, or its best substitute. These results are modified by location, stage of progress, and the age and condition of the patient.

The gradual evolution which has led up to the treatment in vogue today makes an interesting study. Previous to 1870 operative treatment on cancer of the rectum was limited in extent, and performed only by the great surgeons of that time; in fact, it was almost limited to palliation and lumbar colostomy.

At present a diminishing number of patients present themselves at such a late period that they fall within the limits of this type of surgery. Inguinal colostomy has replaced the lumbar. During the next ten years (to 1880) there was a marked advance in all branches of surgery. Instead of a few surgeons with initiative, a large number were making active scientific progress. New and often similar methods of procedure were devised by surgeons widely separated, and each without knowledge of the investigations of the others. This progressive spirit, which fortunately continues, resulted in many operations bearing the names of two and even three surgeons who had advanced the principles at about the same time.

In rectal surgery there were developed the circular enucleation of Lisfranc, perineal excision, Dieffenbach's incision anterior and posterior to the anus, and the great advance made by Kocher in

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*Read at the Twelfth Annual Meeting of the Western Gyn. and Surg. Assoc., December 29, 1902. Reprinted from "Jour. Amer. Med. Assoc.," April 25, 1903.

1874, when he excised the coccyx to gain access to the rectum. Many surgeons still contend that by this method sufficient space is secured to accomplish the removal, in all cases which should be attacked from below. Verneuil also deserves credit for removal of the coccyx at this time.

The difficulties most marked during this period were sepsis, which could not be avoided, stricture or incontinence from the loss of the anus, and recurrence, the most serious of all, as well as the most frequent. The recurrence most commonly seen was probably from incomplete removal, and at times undoubtedly from direct inoculation of the wound by the cancer. The direct inoculation of wounds by both cancer- and sarcoma-cells is a condition well understood today, and many operators to a certain extent avoid this complication by excising the anal and low-lying cancers of the rectum with a Paquelin cautery; others, when the cancer unavoidably contaminates the wound, apply carbolic acid, followed by alcohol, to prevent germination and absorption.

During the years from 1880 to 1890 the germ theory was developed which revolutionized surgery and medicine. This period was one of antisepsis and drainage. Operations in all lines of surgery became more radical. The perineal methods were made more complete. Rehn and Campenom, at about the same time, brought out the vaginal route for certain cases of rectal cancer, a method which has been so highly developed and popularized by Murphy. Steinthal removed invaginating cancers by means of an elastic ligature. In 1883 Volkmann opened the sacral canal in an operation for sarcoma. Kraske, at that time his assistant, noticing that no harm resulted, was led to develop his sacral excision method of operation. Now all varieties of sacral exposure bear his name, although variously modified by Bardenheuer and others in being more extensive, by Heineke, Roux, Rehn, and others in preserving the bone by a temporary resection, and by Zuckerkandl in making a parasacral incision.

The difficulties which arose were from shock, which usually meant loss of blood; from peritonitis, as two-thirds of the Kraske operations necessitated opening the peritoneum; and from the attempt to perform radical operations on inoperable cases, as the damage to the bone, loss of blood, and open peritoneum were necessary by this method before the operator knew fully the extent of the disease. The anus was usually sacrificed. Various methods of uniting the distal and proximal bowel were devised. Suture methods frequently failed, or partially failed, leaving permanent fistulas, as did all methods much too often, were they plastics, Murphy button, or invagination. The Hochenegg method of invagination, by passing the proximal end through the anus and suturing to the skin, was later modified by removal of the mucous membrane of the anus. One of the best methods was to draw the proximal bowel through the anus, which was inverted, and make a circular suture union, which is replaced within the sphincter. Lange made a half-circular incision anterior to the anus, admitting of its being depressed 2 inches to reach the proximal end. With the anus saved, it was often found that the extensive mutilation had permanently injured its nerve-supply, and when saved intact, that it required the levator ani and internal sphincter to render it functionally perfect in preventing the sudden escape of gas and thin feces.

Gerster states that practically all these methods of union result in primary or secondary stricture. Most frequently it was found that so much bowel had been removed that a sacral anus was necessary. When an artificial anus was determined on, Witzel, Wilms, and Rydygier recommended the division of the gluteus maximus, made at one side of the sacral incision, and the suture of the bowel end to a skin incision, thus gaining muscular compression. Gersuny rotated or twisted the bowel sufficiently to close its lumen and sutured. In spite of all methods, only approximately 15 per cent. of these patients secure anything like a controllable anus. The incontinence which ensues is not comparable to those cases of torn or paralyzed sphincter or sacral fistula, as such cases still have the 17-inch loop of sigmoid in the pelvis, whose value as a fecal container was pointed out by Wyeth, with the natural constriction at the top of the rectum to control the fecal current. Yet such cases presenting themselves for relief are often considered improved by an inguinal colostomy. The local recurrence, which is so frequent, often causes such a degree of obstruction as to require a later colostomy, a condition which we met in 3 cases. The direct channel of the colon from the splenic flexure to the outlet leaves no space for a fecal container, and renders closure a question of hydrostatics in these operations.

The last decade has marked an advance in methods derived from an analysis of the mortality and failures in the past, and the gain has resulted in the present thoroughness of surgery and in the substitution of asepsis for antisepsis. The block removal of the rectum and glands, where possible from below and in high location of the cancer, the combined abdominal and perineal method of removing rectum, glands, and all malignant tissue *en masse*, is the new surgery for cancer of this region. This method is merely the application of principles of the general surgery of cancer, regardless of location, as exemplified by Halsted's operation for the removal of cancer of the breast. It is probable that the removal of cancer of the rectum in the past compares well with the removal of cancer of the breast before the radical operations were made on the lymphatic system, with the exception of the former being in a more septic region. The combined abdominal and perineal method is now advocated for high rectal carcinoma by the pioneers in rectal surgery, Kocher, Kraske, Gaudier, Quénu, Trendelenburg, Abbe, Weir, and numerous others.

Cancer in the young is much more serious than in the old, both as to rapidity of growth and early involvement of the glands, although frequently the glands are involved only late in the disease. The average life with cancer of the rectum is given as from one to two years; this may be true in the young, but in the old, if we approximate the commencement, it must often exceed double this length of time.

Allingham considers the removal of cancer in patients under forty-five years of age as unfavorable; between forty-five and sixty years, as more favorable, and over sixty years, still more hopeful. Statistics change from year to year with the ability of the operator, whose judgment increases from his mistakes and failures, and whose ability to select a justifiable operation for rectal cancer, according to the extent, location, fixation, glandular involvement, cachexia, and age, or invasion of neighboring organs, such as vagina, uterus, prostate, or bladder, becomes more and more reliable. Therefore statistics mean more to the surgeon who makes them than to any one else. Kraske's mortality in the first 10 cases was 40 per cent.; this he has now reduced to less than 10 per cent. The average mortality is still somewhere between 15 and 18 per cent. Hochenegg, in 121 sacral operations, had 5 per cent. mortality and 25 per cent. cures.

Krönlein answers three questions: mortality of operation, recurrence, and functional disability; 881 cases show that the sovereign method is extirpation, 80 per cent. survive, 14 per cent. are lasting.

The functional result is best when possible to preserve the anus and sphincter. In the discussion Kraske expressed satisfaction in his 120 cases of sacral method, but thinks the combined abdominal sacral method more radical. Gaudier, of Lille, begins with a laparotomy, and by section of the bowel at the iliac fossa makes an inguinal anus. The peritoneum is cut from the sides of the rectum and below, and the rectum forced down by blunt dissection as far as possible, the peritoneum closed, and the operation completed from the perineum. Gaudier claims the method is of aid in: (1) Complete extirpation of the cancer; (2) removal of lymphatics; (3) the possibility of complete asepsis; (4) no bony mutilation; (5) the artificial anus is more supportable and more easily supervised than in the sacral region.

Quénu separates the cancer by sacral operation first, then, if necessary, makes an abdominal incision and inguinal colostomy. Chalat, of Toulouse, practically performs Gaudier's operations.

We were compelled, in 2 cases, to operate from the abdomen in one and from the abdomen and perineum in the other. During the past year we have operated on 4 cases in which the combined operation was planned previously. The operation, as described by Gaudier, we modified in regard to the colostomy. Through a median opening the sigmoid is double clamped and cut at a point as low as possible, yet well above the cancer; the mucous membrane is then inverted, and both ends closed with a purse-string suture. This renders the remainder of the operation aseptic. The superior hemorrhoidal artery is ligated, and the proximal sigmoid segment is loosened and brought through a McBurney gridiron incision in the iliac fossa. This incision is peculiar in the skin incision, being at a distance of 1½ inches to one side of the muscle separation. The end of the bowel is brought out and sutured to the skin incision; also a few sutures unite the bowel to the peritoneum at the point of exit. This preserves the loop of sigmoid as a fecal container. Prolapse is prevented by sutures from within; the muscle separation and sigmoid curve of outlet with skin covering for compression give a fairly controllable anus at a position where the patient is enabled to give it proper attention. If the median incision discloses an inoperable condition, that is, inoperable from a curative standpoint, from metastasis in glands or neighboring organ involvement, an inguinal colostomy is made and the median wound closed.

Colostomy is usually performed by lifting a loop of sigmoid through an abdominal iliac incision. The loop is supported by one of the various methods, and the bowel is sutured to the peritoneum and skin, forming a true funnel-shaped hernial opening in the abdominal wall; that is, skin and peritoneum in contact. The best operation is that of Mixter, in which the sigmoid loop is drawn through a McBurney gridiron incision, and a rectangular skin-flap pedicle attached at one end drawn through an opening in the sigmoid mesentery. The skin-flap is sutured back to place at the free end, and sutures applied to the bowel, peritoneum, and skin. When the loop of bowel is cut through, this skin covering of the bowel acts as a valve when compressed by a pad.

To sum up the main objections of the past we have:

1. Ineffectual removal with local recurrence, so common in the perineal type.

2. The extensive mutilating character of the Kraske before operative conditions were known.

3. The frequent failure of all methods of union of proximal

and distal portions of the bowel, which, when united and the anus saved, with the destruction of the levator ani and internal sphincter, represented but one-third of the controlling apparatus of the bowel.

4. The frequent formation of stricture, either cicatricial or cancerous, following operation necessitating inguinal colostomy.

5. The straightening and tension of the sigmoid destroyed it as a fecal container.

6. That sentiment and not chance has proved the main reason for continuing to place an uncontrollable anus in a comparatively inaccessible situation.

The gain in the combined operation has been in a selection of the operation to the case, either radical removal *en masse*, with all glands, fat, and connective tissue, or a colostomy for palliation, the retention of the sigmoid as a fecal container, and the peculiar formation of the anus giving a fair degree of control in an accessible situation.

CANCER OF THE SIGMOID AND RECTUM*

CHARLES H. MAYO

To obtain the best results in the cure of cancer it is essential: (1) That the disease be situated in tissue or in organs that can be removed without causing death; (2) that the disease be confined to the structure of its origin and the immediate lymph-nodes tributary to it. These conditions may be, to a great extent, changed by the type of the cancer and the age of the patient, cancer being, relatively, more rapidly disseminated in the young, with their active lymphatics, than in the aged, with their natural vessel changes.

In considering cancer of the rectum and sigmoid, we find that three males to one female are thus affected. With regard to the frequency, Herman's collection from the Prussian hospitals shows that, approximately, one-half of all cancers affect the alimentary tract, and one-sixth of these are in the large bowel. Ewald's collection of over 1100 cases gives their location as about 9 in the rectum to 2 in the rest of the colon.

Cancer extends by continuity of tissue and through the lymph-nodes, rarely by veins, especially portal, causing liver-nodes and grafting on peritoneum. It may be said of the disease in general that the secondary or metastatic growths are the usual cause of death where tubular structures are not involved. It is now known that Nothnagel's estimate of the duration of life with cancer of the bowel, which he gave as from six to twenty-four months, is very often exceeded. Infection in some organs or regions rich in lymphatics, like the lung, neck, or axilla, early involves the glands, but the colon, with a reduced lymph-supply, brought about through ages of resistance to bacterial life, of which it is a natural harborer, often holds malignancy for a long time as a purely local disease.

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*Read before the American Surgical Association, Cleveland, Ohio, May 31, 1906. Reprinted from "Surgery, Gynecology and, Obstetrics," August, 1906.

The large bowel is the drier of the fluids delivered from the small intestine, where the bulk of the proteids are extracted. It is probable that Metchnikoff is too radical in his views concerning its elimination, overlooking its value as an absorber of water.

The lymph drainage of the anal portion of the bowel passes to the inguinal glands, while that of the lower rectal passes laterally in the region of the middle hemorrhoidal vessels. A few lymph-channels are tributary to the pudic glands, while the greater portion gather above the levator ani muscle and pass up the midline with superior hemorrhoidal vessels to the prominence of the sacrum.

Haussman, in 112 collected autopsies of those dying of cancer of the bowel, found that 55 were limited to the bowel; of the remainder, but 36 involved the lymphatics, and 21 showed general infection. Such conditions would be expected to occur above the rectum, from the lymphatic condition.

Treves, in his report of 100 cases of stricture of the bowel, found 70 in the descending colon and sigmoid, 58 being in the latter situation.

We have, then, a disease in a removable structure which is slow to disseminate infection, and yet, approximately, only one-half of the cases are discovered at an operable period, as far as curability is concerned, being usually called external or internal piles if low. This is due to the lack of marked symptoms in the early period, to the carelessness of the patient, and often to the failure of the physician to examine, although he prescribes.

There is more excuse for delay in those cases occurring above the rectum, and here we must consider that attacks of obstruction of the large bowel occurring without inflammation in individuals beyond middle life are indicative of stricture, which is probably cancerous. Early symptoms of cancer may be relatively trivial, as diarrhea, or alternating diarrhea and constipation, passages of mucus and blood, and the presence of piles.

The usual type of malignancy here is adenocarcinoma. It begins in the mucous membrane, and later invades the muscular and peritoneal tissues. According to Ball, tumors felt outside the rectal wall, and not attached to the mucous membrane, are not cancer; tumors of the mucous membrane not attached to the muscular coat are adenomatous, and not as yet distinctly malignant.

In most of the work done on cancer too little attention has been paid to the character of the cancer in basing the prognosis. This subject has received particular attention in the report of the surgical clinic at Heidelberg by Peterson and Colmers. They found that, microscopically, solid carcinomata return in every instance. The adenocarcinoma they divided into simplex, papilliform, microcysticum, and gelatinosa. The colloid form gave 100 per cent. of recurrence; the simple adenocarcinoma had an exceptional cure, while the microcystic and papilliferous remained well. All mixed forms, like the polypoid, recurred, the superficial ulcers usually being adenocarcinomata, the simplex giving an occasional cure, while the deep circular ulcers with nodes have a poor prognosis from early dissemination.

When cancer involves the sigmoid, a large majority of cases will require an exploratory incision to determine the exact nature of the affection, as well as its location. If cancer, the question at once will arise as to whether or not it is possible to extirpate the growth. The removal will be decided by the extent of the invasion of the lymphatics, adjacent structures, or liver, also the age and general condition of the patient.

When possible, the diseased area is removed and some form of immediate anastomosis performed, usually suture, either with or without colostomy, which may often be necessary to relieve temporarily the oftentimes enormously distended and impacted condition of the intestines above the disease. It frequently becomes necessary, immediately after opening the abdomen, to relieve the gas or fluid distention by puncture of the bowel with a trocar.

In removal of sections of the colon we can place considerable dependence upon the integrity of the blood-supply, which resembles, in this respect, the tolerance of the stomach, so that suture anastomosis is made in an increasing number of instances. Where it cannot, for various reasons, be employed, and it is desired to obtain the temporary advantage of a colostomy with a later closure of this opening, it is accomplished in the following manner (Mikulicz). The open ends of the bowel are sutured together for two-thirds of their circumference, exactly like an end-to-end anastomosis, the opposing sides of the bowel being also sutured together for 4 or 5 inches. A small abdominal opening is now made at a favorable point, and the bowel union drawn into this incision and secured by sutures, the larger abdominal incision being closed. A couple of weeks later a pair of large forceps are passed into the artificial anus, one blade into each portion of the bowel, and clamped together. The clamps are tightened each day for four or five days until they cut their way through and reëstablish the lumen of the proximal and distal portions of the bowel. There is no danger of clamping the small intestine; the large bowel having been sutured laterally, prevents their passing between the clamped portion of the bowel. The external fistulas can be closed at any time, thus practically making an intra-abdominal intestinal anastomosis without an incision. We have employed this method four times, with a perfect result. The same result can be obtained by joining the distal end to the side of the proximal bowel, the end of the latter being brought out of the abdomen for a temporary safety colostomy.

In case the tumor is not removable, the diseased area can be short-circuited by uniting the bowel above and below the obstruction. If the bowel is empty, suture anastomosis or the McGraw ligature is employed. Especially is the latter useful in cases with an excess of free peritoneal fluid and where the tumor is not removable. However, extensive operation in such cases is a questionable procedure in most instances, as the reparative powers of the peritoneum are so reduced. The anus is thoroughly dilated at the close of all operations, and a gas-tube inserted into the rectum.

Certain definite results are desired in operations upon cancer of the rectum; namely, permanent cure, low operative mortality, and a controllable anus or its best substitute. Cancers of the rectum can be clinically divided into two main groups: (1) Those within easy reach of the finger, not exceeding from 2 to 2½ inches in distance from the anus; (2) that larger group which lies above the levator ani muscle, and can be reached digitally with more or less difficulty.

The first group can be disposed of in a few words. The lower end of the rectum, with the growth, can be dissected out through the perineum, aided by an incision backward and removal of the coccyx if necessary. This incision is usually sufficient, but may be extended by continuing it upward along the side of the sacrum until ample space is secured. Occasionally an operation started in from the perineum develops unsuspected glandular metastasis at a higher level, justifying a Kraske operation, the fourth and fifth sacral vertebræ being removed to give additional room.

In the female, this anterior route may be chosen instead, and by a free incision through the posterior wall of the vagina operating space may be obtained (Murphy, Byford). In either method the hemorrhage may be readily controlled, as it is almost entirely from small branches of the internal pudic and coccygeal arteries and from the inferior hemorrhoidal plexus.

The results of operation for low rectal cancer are essentially unsatisfactory, particularly in the male, on account of the urethra, prostate, and neck of the bladder. As the entire muscular apparatus of the rectum is removed, control is not to be expected. Therefore extensive dissections for the purpose of drawing the rectum down to the anal margin are not of great value.

The skin around the anus can often be mobilized sufficiently to reach up to the rectal stump. This can be facilitated by lateral incisions and by undermining the skin, securing in this way two flaps attached at each end, which can be slid up into the space.

Surprising to relate, many patients retain very fair control, as the sigmoid, which is the natural fecal container, has not been interfered with, and unless the stool is loose, involuntary escape may not be sufficiently frequent to be a source of great discomfort.

In some individuals the rectum will retract, leaving a considerable extent of scar tissue. This is funnel-shaped toward the outer side, and usually does not give rise to annoying stricture. Occasional wearing of a rectal plug overnight produces the required patency.

If the prostate is involved to any extent, more extensive operations are needed, and as the region can be better seen by the posterior incision or Kraske operation, this route, in cancers which lie two inches above and yet entirely within reach of the finger, is the most satisfactory, although it will be necessary to open up the peritoneal cavity and loosen the bowel until the upper fragment can be approximated to the anal margin.

We believe the foregoing covers the clinical usefulness of the lower posterior operation. The mortality is from 5 to 10 per cent., and permanent cures are to be expected only after early operations. Unfortunately, the disease is usually supposed to be piles until too late for cure. We have had a few satisfactory results.

The second group is by far the larger, comprising, as it does, all those cases which lie above *easy* reach (2 to 2½ inches) of the examining finger.

In the case of the lower route, the arguments in favor of some form of posterior or Kraske operation for high rectal cancer are numerous. It brings the operator down at once upon the region of disease. If the lower end of the rectum, including the levator ani muscle, as well as the internal and external sphincters, is not involved, the upper fragment, by loosening the lower sigmoid, can be drawn down and directly sutured to the distal end; or if only the external sphincter is saved, after excision of the mucous membrane the upper fragment can be drawn down and united to the anal verge.

The disadvantages of this method are many. The operation is a bloody one, much of the hemorrhage being difficult to control except by hot gauze packing. Inspection of the operating field is not ample and clear, especially at the upper part. In particular, one cannot make that high removal of lymphatic glands and possibly infected fat which we have learned is the most important safeguard against metastasis.

As a matter of experience, it is shown that a direct end-to-end union is by no means a satisfactory procedure, even providing it can be done. The lower fragment, having no peritoneum, does not unite readily, and the upper end, being invested with peritoneum only on its anterior and outer aspects, does not furnish sufficient of this structure to safeguard plastic union. It is true that the peritoneum can sometimes be loosened and sutured around the upper portion, giving it a complete peritoneal investment. But the rule is that union is not complete, and small but intractable fistula at some point results. Generally the muscular apparatus of the rectum is necessarily so badly damaged in the removal of the disease that even if the bowel can be drawn down to the anal margin, muscular control will be incomplete and unsatisfactory.

The operation for hemorrhoids known as the "American" (Whitehead), a simple procedure as compared with this, frequently causes either stricture or incontinence.

In many cases the bowel cannot be drawn down, necessitating a sacral anus, which is exceedingly unfortunate, as the situation is one which is inaccessible to the patient, rendering cleanliness difficult. If it is necessary to pull the bowel down to any great extent, the sigmoid loop as a fecal container is destroyed, and frequent and uncontrollable stools the rule.

The surgeon may hesitate to remove, resolutely, regardless of consequences, all of the tissue which is infected, but which lies outside of the directly involved area, as he has in mind continually the desirability of giving future continuity of function. Lastly, the surgeon is unable to judge of the limits of the disease above until the operation is nearly completed, and many victims of cancer of the rectum are subjected to an unavailing and mutilating procedure which would not have been undertaken had the operator known beforehand the extent of involvement.

Attempts to obviate some of the disadvantages of the sacral operation have been made, especially as to securing a larger field by osteoplastic resections. The best of this class is the one in which a quadrangular flap, with its base at the anus, is made by lateral incisions extending up to the fourth sacral vertebra, the fourth and fifth sacral vertebræ being separated from the sacrum with a chisel and the trap-door turned downward.

Osteoplastic resections interfere with free drainage, and removal of the bone is not difficult, nor does its retention add anything to function.

The mortality after the sacral operation has been considerable, largely due to infection, on account of the difficulty of securing and maintaining freedom from fecal contaminations.

We have followed the advice of Hochenegg in carefully clearing out the bowels two days in advance of the operation, and allowing at least twenty-four hours to elapse for the stools to become formed before operating.

In order to avoid infection from the common source it has been the custom of some surgeons to do a preliminary colostomy for the purpose of diverting the fecal current, to be followed by the radical operation after an interval of from ten to fourteen days. This abdominal incision can also be utilized for the purpose of exploring the upper limits of the growth and the glandular involvement before making the fixation of the sigmoid.

The disadvantage lies in the fact that if the mesentery of the sigmoid is short, attachment to the abdominal wall may entirely prevent drawing the bowel down to fill the gap left by the resection, and the abdominal section must be unnecessarily large, as an exploration is inadequate without the introduction of the entire hand into the peritoneal cavity.

Permanent colostomy without removal of the growth has not sustained its reputation of ten years ago. It has few advocates, unless actual obstruction is imminent. As McBurney points out, obstruction from a low growth, unless of the annular variety, is better treated by curetment than by colostomy, and especially cauliflower growths, which seldom redevelop in such a way as to interfere seriously with the fecal current after thorough scraping out.

What results may be expected from the sacral operation? In a series of forty-six cases operated by sixteen New York surgeons

Hartwell showed a mortality of 26 per cent., and only 16 per cent. living beyond the three-year limit: certainly, a poor showing when one considers the disability which attends upon the majority of those who do not die from the immediate effects of the operation. Our results after this operation have been about as Hartwell reports.

In 1897 Quénu recommended a combined abdominal and perineal attack upon rectal cancer, and the operation which he advocated, modified to a greater or less extent, has had an increasing number of advocates, notably Weir, Abbe, and Tuttle in this country.

In common with the majority of surgeons, we have become dissatisfied with the sacral route, excepting in selected cases, and for five years have practised a modified Quénu operation upon patients who would consent to it. For sentimental reasons a large number of individuals elect the posterior operation even after careful explanation.

The Operation of Choice for High Rectal Cancer.—Bearing in mind that the lymphatics of the lower rectum first pass laterally with the middle hemorrhoidal vessels and then converge posteriorly in the mesorectum with the superior rectal artery, it is evident that any operation, to be effective, must remove the entire chain of glands with all the fat as high as the promontory of the sacrum.

The method of procedure is as follows: The patient is placed in the high Trendelenburg position, and the abdomen freely opened in the mid line. The upper limits of the growth and its relation to the surrounding tissues are noted. The possibility of the removal of all the obviously infected glands is ascertained, and the liver examined for embolic carcinoma. If the case is a favorable one, the intestines, with the exception of the sigmoid, are carefully packed away with large gauze pads; two clamps are caught across the lower sigmoid on a level with the promontory of the sacrum, and the bowel divided between. The mesosigmoid is liberated by lateral incisions, and the proximal fragment brought up outside of the abdominal wound. A ligature is thrown around the bowel immediately below the forceps, which are removed as the ligature is drawn tight. A purse-string suture is placed an inch below the end of the stump, which is invaginated in a manner similar to that of the appendix. The ends of the ligature are left long. The threads and stump are carefully cleansed. The distal stump is treated by inversion in a similar manner, to prevent soiling. Lateral and anterior peritoneal incisions are now made, liberating the rectum from the bladder and prostate in the male and from the uterus in the female. The inferior mesenteric artery, which is the upper continuation of the superior rectal, is caught and tied above and to the left of the promontory of the sacrum at as high a point as can be safely done without interfering with the nutrition of the bowel used in the colostomy. The fat is carefully separated; the entire mass of gland-bearing fascia, with the fat, is wiped perfectly clean to the periosteum. The middle sacral artery is of considerable size in most cases, and should be caught and ligated near its origin from the abdominal aorta between the common iliac vessels. The dissection is continued downward, exposing the internal iliac vessels and the ureters. Most of this can be done by sponging. The middle hemorrhoidal vessels are caught laterally as they come off with the inferior. The entire area is now packed with hot moist gauze, and the patient put in the perineal position. In some cases, if the bowel is healthy for a space of four inches above the anus, it is clamped and ligated and cut above the ligatures, the diseased area being removed. The operator, or preferably a second operator, begins the lower part. A pair of forceps are passed into the blind pocket of bowel from below, the tied end of the bowel is pushed into the open forceps, and they are withdrawn through the anus, inverting the bowel.

After cleansing, the thread of closure is cut, and the forceps are now passed through the invaginated bowel and anus into the pelvis to grasp the proximal end of the bowel, which is withdrawn, and the two ends united by a circular end-to-end closure outside the anus and allowed to retract. Drainage is secured by a midline incision in front of the coccyx, through which tube drainage into the pelvis is made. This type of operation (Maunsell) we were able to make in 4 cases. In some colostomies the lower end of the rectum can be saved as a blind pouch, or temporarily employed for drainage of the pelvis. Should the disease require such extensive removal of the rectum as to destroy the lower rectal wall muscles and nerves, as well as straighten the sigmoid loop, thereby losing both retention and control, it is preferable to save the sigmoid loop as such and make an abdominal anus. To employ this method a small gridiron incision is made on the left side, as would be done on the opposite side for appendicitis, and through this opening, using the ends of the threads as a tractor, the proximal stump is pulled out three-fourths of an inch beyond the skin surface. Three or four linen sutures are quickly placed, uniting the bowel to the peritoneum on the inner side, and a silkworm-gut suture on the outside closes each angle of the wound, including in its bite the skin, aponeurosis of the external oblique, and the wall of the bowel, holding it securely in position. If this plan is followed, the operator from below, after inserting the gauze in the rectum to facilitate subsequent dissection, and closing the anus by a circular suture, circumscribes the anal margin with a deep incision, and dissects the perineal portion of the rectum, with its muscles and fat, free from the prostate and urethra, or from the vagina in women. This extends up to the levator ani muscle, which forms the boundary between the upper and lower dissections. The abdominal operator now passes down the fragment of lower sigmoid and the upper end of the rectum with its fat and glands into the perineal opening, where they are removed by the surgeon working below, or one operator, with changes of gloves, can accomplish the work in both fields. All bleeding points are caught and ligated. A considerable sized gauze drain is passed from above downward, leaving its upper end just exposed on a level with the peritoneum, which is drawn together to cover as much as possible, the external gauze portion being brought out of the perineal wound. The sigmoid loop from above is placed over the exposed surface, and in the female the body of the uterus and broad ligaments are adjusted, with a few sutures to aid in covering. The upper incision is completely closed, while the perineal opening is narrowed to proper dimensions for drainage by a few sutures.

The end of the sigmoid is left completely obstructed for the first twenty-four hours, after which time the circular suture is cut and the stump everted by the ligature, which is tied around it, and the bowel opened.

The advantages of this operation are obvious. The disease is removed widely, with all of its tributary lymphatics, muscles, and related tissues. The anus is placed in a position easy of inspection and cleansing; the sigmoid trap obviates the necessity of frequent stools, and the intermuscular incision gives a fair degree of control.

HERNIA

SUCCESSFUL OPERATION FOR LARGE VENTRAL HERNIA*

W. W. AND W. J. MAYO

Five years ago we removed a 32-pound multilocular ovarian cyst from Miss A., aged seventeen. She was an undersized girl, whose normal weight was less than 100 pounds. The tumor involved the left ovary. In six weeks she married, and within the year was delivered of a large boy. The weight of the pregnant womb ruptured the cicatrix, and the entire uterus anteverted into the ventral hernia thus formed between the recti muscles. Sixteen months later she was again delivered at term, leaving the hernial sac still larger and constantly filled with intestines.

In December, 1886, the left ovary became cystic and grew to enormous size, filling the abdomen and hernial sac. She was greatly emaciated and dropsical. In January we removed a multilocular cyst through a 5-inch incision without special difficulty. Catgut ligatures were used on the many vascular adhesions, and braided silk for the omental stump and left broad ligaments which formed the pedicle. The tumor weighed 62½ pounds. We now removed the entire hernial sac, consisting of peritoneum, skin, and dropsical cellular tissue. Its size was equal to an ordinary wooden pail, and the incision laid the abdomen open from 2 inches above the umbilicus to the pubes. She was turned on her side, and the abdomen flushed with hot water. The peritoneum and recti muscles were sutured with buried interrupted catgut sutures. The skin was sutured separately and in a like manner. There was no discharge, and the drainage-tube was early removed. Her recovery was prompt, and the result all that could be desired.

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*Reprinted from the "Northwestern Lancet," May 1, 1888.

RADICAL CURE OF HERNIA*

WILLIAM J. MAYO

I take for granted that at this period of modern surgery there can be no question as to the justifiability of the radical operation as applied to certain forms of hernia, although much divergence of opinion may exist as to the indications for such treatment.

It has been the consensus of opinion among surgeons that a hernia which could be easily retained by a truss should not be operated upon for radical cure. But there is a growing minority who believe that these limitations are too narrow, and that, other things being equal, the radical operation should be considered, with the possible exception of, first, the very young, in whom a permanent cure may be obtained in a considerable number of cases by mechanical means, and, second, in the old, who have passed beyond the period of physical activity. All are agreed that the radical operation should be done following the reduction of strangulated hernia if the condition of the patient warrants the procedure, and also that it is strongly indicated in irreducible hernia.

Personally, I believe in and practise the radical operation in all cases of irreducible hernia in those otherwise of sound health, and in the majority of reducible hernias that appear during the period of physical activity, that is, between infancy and old age.

The injection method of treatment originally introduced by Heaton cannot be considered a radical cure. From personal experience with it more than ten years ago I believe it to be ineffectual, if not worse.

In considering the various operative methods which have been applied to the radical cure of hernia, I shall briefly discuss the steps of the operation, rather than give a description of the separate methods of operation and their modifications.

*Reprinted from "Northwestern Lancet," 1895, vol. xv, pp. 327–330.

INGUINAL HERNIA

The incision for this operation has been a matter of some importance. The well-known difficulty of securing a reliable asepsis of the skin of the groin and the frequency of stitch abscesses in this locality led Kocher to recommend a transverse incision above Poupart's ligament, and Cheyne to practise a skin-flap turned down from the belly-wall. In showing the cause for this to be the deep-lying Staphylococcus epidermidis albus, Welch enabled Halsted to secure an almost certain primary union by a new application of the old subcuticular stitch. Such union is of vital importance to avoid the secondary infection of the permanent buried sutures, if they are used, and under any circumstances to prevent the formation of relatively weak scar tissue from suppuration. With the exception of Kocher's buttonhole of the external oblique for the purpose of drawing out the sac, all modern surgeons are agreed that the inguinal canal should be freely opened to or above the internal ring. Halsted, in particular, recommends that the internal oblique and the transversalis muscles be cut much higher, and the resulting flaps drawn down to strengthen the weakened wall below the point of emergence of the cord.

The Sac.—Macewen, Hall, and Kocher, as a rule, do not open or remove the sac, but by some peculiar arrangement of its folds hope to avoid danger and add to the strength of the supporting wall. Macewen's operation is by far the best of its class, the sac being coiled up on itself and pushed within the abdominal cavity; therefore it does not act as a plug, and increases the size of the opening necessary for the cord to emerge, which is the objection to both Kocher's and Ball's methods. In a recent paper Ferguson emphasizes the importance of utilizing the sac as a buttress, after the method of Macewen. This loses much of its force when we stop to consider that the sac is one of the natural coverings of the hernia, and would not develop more resisting powers in the future than it had in the past. McBurney says that the sac should be freely opened and removed to a point well behind the internal ring. In congenital hernia a sufficient portion of the sac to form a tunic to the testicle should be left and neatly sutured, the balance being removed. In very large and old hernias Deaver calls attention to the danger to the testicle in prolonged attempts to secure the lower end of the closely adherent sac, and he believes it wise in such cases to leave a portion of it behind.

Contents of the Sac.—The omentum, if adherent, should be ligated in small sections, preferably by catgut, and the protruding part removed. Ochsner believes that, since the omentum, as a rule, acts as the entering wedge, it is best to remove a portion of it in every case, whether in the sac and adherent or not. The advisability of its needless ligation may, perhaps, be questioned, as the liability of omental stumps to inflammation, pointed out by Bull, is a slight danger, and should be borne in mind. I have seen 2 cases of this character.

Degenerative changes in an old adherent omental protrusion are of not infrequent occurrence, and may lead to some difficulty in making out the actual conditions present. In all cases of adherent omentum care should be taken to break up the adhesions about the abdominal face of the internal ring.

The intestines are seldom adherent to the sac, but may be closely connected with the omentum, and its occasional presence inside an omental protrusion should be looked for in cutting the omentum away.

The appendix is not infrequently present, and should be removed after the method of Dawbarn. The bladder may form a part of the hernia. Two years ago, in doing a Bassini, I was surprised to find, within a bunch of tough, yellow fat, a hollow organ containing fluid. After some delay and with free opening of the sac it was recognized as the extraperitoneal portion of the urinary bladder. The somewhat free opening was carefully closed, the hernial sac closely sutured, and the wound treated by the McBurney plan, with cure.

Curtis tabulates some 41 cases of injury to the bladder in hernia operations, with a mortality of 25 per cent. Many were not recognized at the time and treated, which accounts largely for the death-rate. Rare instances of the prolapse of the ovaries and uterus or other structures into the sac are of more interest as surgical curiosities than of practical importance.

The Cord.—The difficulty of maintaining the obliquity of the inguinal canal and necessity of at least a small internal ring on account of the presence of the cord has been the flaw in all radical operations until Bassini made the revolutionizing recommendation that the cord be removed from its bed and laid in a new gutter formed by double suture of the aponeurosis of the external oblique. Postempski modified this still further by bringing the cord out beneath the skin, and Halsted, by looping the cord upward and removing redundant veins to lessen the necessary size of the internal ring, made the last step in the chain which was needed to change the proportion of failures to secure a permanent cure, as stated by Bull to be about 40 per cent., to less than 5 per cent., and this without adding to the danger or difficulties of the operation itself. Halsted cautions against too free removal of the veins, and notes several cases of atrophy of the testicle following upon it. In the female the round ligament can be shortened and sutured to the deeper structures, giving an unbroken abdominal wall.

Closure of the Wound.—To secure firm closure of the wound is a problem which has had much attention. Catgut, even when chromicized, is not sufficiently lasting. The kangaroo tendon introduced by Marcy is more lasting, but is expensive, stiff, and, as purchased in the market, not reliably aseptic. Silk, which has had a number of advocates as a permanent suture, has great liability of secondary infection, and this is true of silkworm gut, although Murphy greatly favors this latter material, and is careful in using it to cut very close to the knot.

The inhibitory action of silver upon the growth of pus-germs has been shown clinically by Halsted, and experimentally by Welch. Undoubtedly, silver wire used as a buried mattress suture is by all odds the best method of closure of the deeper abdominal walls. The subcuticular skin suture should be used to prevent stitch abscess, and the wound dressed with an occlusive dressing of silver-leaf or collodion without drainage. This certainly gives the best of results.

In summarizing, it may be said that the method of Halsted, which consists of—(1) The free incision of the canal and prolonging the cut in the deeper muscles above the internal ring; (2) complete removal of the sac and redundant spermatic veins, if present, and looping the cord under the skin; (3) careful closure of the abdominal wall, drawing the cut upper muscles well down below the new opening for the cord, and using the buried mattress suture of silver wire with the subcuticular external suture, and dressing with silver-foil and the usual dry dressing, are the steps in the operation which can be confidently recommended.

McBurney's method will always have a place in surgery, as it enables a reasonable attempt at radical cure to be made in cases in which the aseptic condition of the external wound is open to question, as in a strangulated omental hernia or after bowel resection. Under such circumstances I have used it twice, with a resulting permanent cure. In one case a gangrenous omental protrusion was cut away. Iodoform gauze was carefully sutured over the omental stump with fine catgut, and the whole lowered well into the abdominal cavity and the external wound closed, as recommended by McBurney, except for the abdominal gauze drain. The early absorption of the catgut suture allows the gauze to be withdrawn, as usual, while their effect in enabling the return into the abdominal cavity and accurate placing of deep gauze tampons is worthy of attention. The second case was a resection of gangrenous bowel, during which the external wound was unavoidably soiled.

Femoral Hernia

The treatment is essentially the same as in the inguinal variety. Deaver makes one important recommendation, that the end of the ligature used in tying off the sac should be left long. With a needle the sac is united with the under surface of Poupart's ligament at a higher level with the free ligature end. Barker recommends that the femoral opening be covered by careful suturing of the pubic fascia to Poupart's ligament. Chiene throws a flap of the pectineus muscle across the femoral ring and holds by suture. Of the many methods of securing permanent closure of the femoral canal, I prefer the one recommended by Curtis, which is as follows:

(1) Removal of the sac and suture of the ligated stump well above the internal opening to the under surface of Poupart's ligament. (2) The use of three buried superimposed purse-string silkworm-gut sutures to close the femoral canal. The first circles around the internal opening. This is tied and cut short. The second gathers the tissues together one-fourth of an inch external to the first suture, and the third the outer tissues at the saphenous opening.

Umbilical Hernia

The nature of the structures from which closure must be obtained, and the fact that these hernias are often found in fleshy people with a large portion of the omentum adherent to the sac, render the radical cure an operation of more than average difficulty, with less than average results. The method recommended by Greig Smith, which consists essentially of complete removal of the sac with the adherent omentum, free lateral cuts into the margins of the ring to expose the muscle, and closure with two or three rows of buried silkworm-gut sutures, is a reliable operation. Boldt reports a number of cases cured by means of a through-and-through silver-wire suture, which is eventually removed.

Little defects in the abdominal wall which are common in the median line above the umbilicus permit omental protrusions which cause gastric distress. These little openings may be easily and successfully closed. I have operated on three cases of this variety of hernia with great relief.

Post-operative Hernia

Ventral hernia as a result of incision of the abdominal wall has been of such frequent occurrence as to form a serious objection to this route when avoidable, and an important factor in the prognosis of abdominal surgery, especially of drainage, has been necessary. Greig Smith says that in making abdominal wounds the exposure of a large muscular space for union is the best safeguard against future rupture, and that, in the closure, the abdominal surface of the peritoneum should not be included in the suture. A good hold of the aponeurosis, the muscle, and transversalis fascia, and peritoneum on its external surface, about one-sixth of an inch from its cut edge, should be taken in the stitch. This, when tightened, inverts the peritoneum into the abdominal cavity rather than everts its edges into the wound to form a sulcus into which the abdominal contents can act as a wedge, and also brings a large muscular surface into apposition. Halsted uses his buried mattress suture of silver wire introduced through the aponeurosis, muscle, and bloody side of the peritoneum near its cut edge. From considerable experience I can heartily recommend it both in closing an ordinary celiotomy wound and in operations on ventral hernias. Greig Smith does not believe it often necessary to open the abdominal cavity in closing ventral hernia. He recommends that the sac should be pushed well in, and, if needed, puckered up with a purse-string suture and left to act as a buffer on the internal face of the closed wound, while the stronger structures are sutured in the usual manner.

Price closes an abdominal wound very rapidly, retracting the skin and peritoneum, and projecting the muscle and aponeurosis, thus securing a broad coaptating surface, while McLaren gets excellent results by suturing the sheath into anatomic position about the recti, and accurately reforming the linea alba. Gill Wylie was the first to point out the useless character of the skin and peritoneum, and the importance of the aponeurosis and muscle in the retentive power of the intact abdominal wall. In the region of the appendix McBurney makes an incision which restores the gridiron arrangement of the muscles, and in the region of the gall-bladder Greig Smith recommends a somewhat similar cut, which produces much better mechanical closure than the usual methods. Having had several cases of post-operative hernia in the region of the appendix and gall-bladder, I have, when possible, practised these incisions with much satisfaction. In conclusion, I would say that in the prevention of post-operative hernia the principles enunciated by Greig Smith in the "Annals of Surgery," April, 1895, are of the utmost importance, and with the Halsted method of closure give as near perfect results in avoiding future rupture as modern surgery will allow. My experience with the radical cure of hernia amounts to above 65 cases. In my earlier work the indications for operative interference were most marked, and failures not infrequent, but in the past three years, during which time two-thirds of the cases have been operated upon, I have had but few failures. From this somewhat limited experience I am satisfied that the radical operation for hernia has a large field of usefulness.

OBSERVATIONS ON THE RADICAL CURE OF HERNIA*

WILLIAM J. MAYO

The retention of the abdominal contents depends upon the muscular and aponeurotic structures. The skin and the peritoneum are the natural coverings of a hernial protrusion, but have little or no value in preventing their occurrence; however, each is a factor in the result which should not be ignored.

One frequent cause of failure to cure following operation for hernia is suppuration in the wound and resulting formation of relatively weak scar tissue in place of normal union, and for this the skin is largely responsible. At the present time, when the material for sutures, instruments, and dressings can be sterilized beyond a doubt, the fingers of the surgeon and the patient's skin are the recognized sources of danger.

The white skin germ has its normal habitat in the sebaceous follicles, and an occasional suppuration from this cause cannot be avoided. The skin, as a rule, is overprepared; the surgeon, humiliated by such suppuration, redoubles his efforts, and the skin suffers—too often the prolonged poulticing with green soap, bichlorid packs, scrubbing, and shaving on the previous day send the patient to the operating-room with the wound site covered with red points, where the white germ is already at work.

From personal experience I can say that, since I abandoned these methods two years ago, primary wound healing has been of almost constant occurrence. The wound site is prepared the morning of the operation by a careful scrubbing with soap and water, using a piece of gauze, not a stiff brush. It is then shaved and covered in the usual manner. The scrubbing is repeated on the operating-table, with the addition of turpentine, if the skin is very oily, and followed again by soap and water, and the wound site is then hardened with alcohol.

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*Reprinted from the "Annals of Surgery," January, 1899.

In suturing the skin, careful avoidance of tension is of the utmost importance. The subcuticular suture gives a very beautiful scar, but if a stitch abscess is formed, the pus will run under the whole length of the wound, which may not be the case with the ordinary methods of closure.

The ingenuity wasted in dealing with the peritoneum has been enormous; the formation of buttresses or peculiar methods of handling a membrane to aid in holding back the protrusion is notoriously impotent and a waste of time. The only object in view is to prevent this membrane from insinuating itself between the muscular and aponeurotic structures and preventing the union of the real retentive agents.

In speaking of the avoidance of hernia after operation Greig Smith says: "Scar tissue is always unreliable, and if possible should be protected by normal structures." The correct application of this principle is shown in the McBurney or the Kammerer incision for the removal of the appendix. In this connection Kocher has pointed out that incisions along natural lines or creases not only give better cosmetic results, but are less subject to pressure, with corresponding diminution of hernia. Bevan's incision for the operation upon the gall-bladder is a fine example of the advantage to be derived from this method.

In the proper management of the muscular and aponeurotic structures lies the cure of hernia, and every means of dividing the necessary scar tissue into different planes, protecting each part by sound tissue, as in the Bassini operation for inguinal hernia, is of the utmost importance. Great care should also be taken in the avoidance of tension in tying sutures, and only enough to bring the parts in apposition should be inserted. In the use of retractors the assistants should be cautioned to handle the tissues gently and avoid injurious traction.

Theodore McGraw has pointed out that incisions posterior to the line of the colon in its fixed portion are less liable to hernia, both because the muscular tissue is thicker, and also because the colon lying in front of the scar prevents the small bowel and omentum from wedging itself into the opening.

In operations for appendiceal abscess, if only drainage is instituted, the opening can often be placed well back with less liability of hernia, although the appendix may require removal later. If the appendix is removed in these large abscess cases, the patient is well rid of a serious problem, but may have a hernia to deal with later.

Inguinal Hernia.—Bassini's operation exhibits in a striking manner the correct application of the principles involved in all hernial operations: instead of a scar in one plane from within out, which was the weak point in previous operations, he divided the scar into two parts and protected each by normal tissue.

The internal oblique and transversalis muscles and fascia are sutured under the cord to the inner surface of Poupart's ligament, and this line of sutures is protected by turning Poupart's ligament back into place over the cord, while the line of suture reuniting the divided fascia of the external oblique is protected by the sound tissues drawn underneath, the resulting union being protected not only edge to edge, but side to side, furnishing broad surfaces for union.

As pointed out by William B. Coley, one suture should be introduced above the new internal ring in the deep layer of sutures, as well as those below; this limits the extent of the opening and prevents stretching above, under pressure.

Postempski modified Bassini's operation by bringing the cord directly through the external oblique, at the site of the internal ring. This has been followed by many operators. In my experience it has proved an objection, as I have seen a number of failures wherein the relapse occurred at this opening, and even when the internal ring is protected by the fascia of the external oblique, as in Bassini's method, the relapse seldom follows the cord, but tends to bulge directly through, stretching and thinning the tissues over the internal ring.

Lucas Championnière has observed that nearly all operations for the radical cure of hernia will show a moderate impulse on coughing, and that this is not an indication of impending relapse.

We have made the typical Bassini operation more than 100 times, and the results have, with few exceptions, been good. We have abandoned kangaroo tendon for catgut sterilized by the Boeckman dry-heat method. Several years ago I performed the Halsted operation a number of times. It is a very good method, and ranks next to the Bassini. The disadvantage is that the scar tissue lies in a single line from within out. The mattress stitch brings broad surfaces into apposition, and the weak scar tissue is protected by permanent buried sutures of silver wire acting as an internal splint. The results were good, but occasionally, even after months, tissue atrophy over wire suture rendered its removal necessary.

The original McBurney operation, which sought to give a great mass of scar tissue to protect the hernial opening, has been abandoned by its distinguished originator, and justly so in non-strangulated cases. It represents a transitional stage in the development of better methods; but I have occasionally found it very useful in gangrenous hernias, where it was necessary to use a drain. Ordinarily such a case is almost certain to relapse, but treated in this way good drainage is secured and a considerable percentage of permanent cures are obtained.

Dawbarn practises burying the testicle behind the muscles, thus leaving an unbroken abdominal wall. This procedure will not prove popular, but in cases complicated with undescended testicle it is a valuable suggestion, at once placing the testicle out of harm's way, and relieving the operator of an awkward factor in the cure.

Operation for the cure of relapsing hernia has been very troublesome. By the time you have raised the cord from its bed you justly wonder if there will be life enough to nourish the testicle. William T. Bull's technic of raising the cord from its bed at all, but picked the sac from it, tied and sutured the deeper muscles over the cord to the under surface of Poupart's ligament, and over this sutured the fascia of the external oblique in the usual manner of the Bassini operation. In operating on relapsing hernia this idea is most excellent, and saves much time and annoyance in raising the adherent cord from its bed.

Relapse, in my experience, is usually a direct protrusion and does not follow the cord, the coverings being thinned and stretched muscular and aponeurotic structures.

Wyllys Andrews, in his modification of the Bassini operation, sutures the inner edge of the incised fascia of the external oblique with the internal oblique, transversalis, and Cooper's fascia below the cord to the under surface of Poupart's ligament, suturing the external edge of the flap over the cord to the surface of the external oblique muscle in an overlapping manner.

As there is a redundance of tissue, this plan of suturing in relapsing hernia is an advantage, as it shortens the tissues. In this way I have quickly and satisfactorily operated upon four relapsing hernias. The external oblique fascia is divided to a point above the internal ring, loosening the outer flap to expose the under surface of Poupart's. The peritoneal sac is incircled by a purse-string suture, and either cut away or reduced and the suture tied. All the tissues except the skin and superficial fascia are sutured over the cord to the under surface of Poupart's, and the external flap of the external oblique overlapped and held by an extra row of sutures.

The external oblique has a larger range of motion than the inner muscles, and may be said to act as a sheath for them. This allows overlapping during the repair of hernial openings at almost any point in the abdominal wall, and adds greatly to the strength of the union.

In both the inguinal and femoral operations the bladder may be drawn with the sac into the wound and injured. In one such case I incised the bladder freely before I discovered the accident. Since then I have been on the watch for this complication, and a number of times have been compelled carefully to dissect the bladder free from the neck of the sac.

Femoral Hernia.—My experience in the radical cure of femoral hernia has been favorable, although, from the nature of the femoral canal and the character of its walls, permanent occlusion would seem to be a difficult matter. In small hernias I have been satisfied with a method employed by Curtis, consisting of three superimposed circular purse-string sutures of catgut: The first at the internal femoral opening, the second one-third of an inch outside of this, and the third at the external surface of the canal. For some very large hernias the method is not suitable, and for these cases I have divided the external face of the ring outward and upward, separating the iliac portion of the fascia lata from Poupart's, then passing a series of mattress sutures through Poupart's ligament one inch back of its lower margin, and catching the pectineus fascia with the inner sutures and the iliac portion of the fascia lata with the outer sutures near its cut edge; drawing these sutures tight, slide the lower fascia under Poupart's ligament; the latter acts as a flap and can be sutured by its lower margin to the tissues below.

A. J. Ochsner lays great stress on removal of a part of the omentum in these hernias, whether adherent or not, as he believes that the omentum is the entering wedge, and, if sufficiently shortened, cannot in the future reach to the femoral opening.

One peculiarity of femoral hernia is the amount of fat lying external to the sac, and which, by the constant congestion, may develop a true lipoma.

In this region small hernial openings through Poupart's ligament, in the vicinity of the femoral ring, but not through it, will occasionally be found. These openings resemble the small ventral hernia in the linea alba above the umbilicus.

According to Bland-Sutton, such hernias are caused by a slight separation of the aponeurotic fibers through which a little fat-tag escapes. The irritation favors a lipomatous condition, and, by traction, a peritoneal pouch is drawn through. Closure is readily effected by direct suture, as there is little tendency to relapse.

I have had no occasion to try the so-called inguinal operation for the cure of femoral hernia.

Umbilical Hernia.—This form of hernia has been the hardest to cure. When found in very corpulent people with small muscular development, the conditions are naturally unfavorable. Surgeons usually advise cutting back on each side to the recti muscles. In two of my earlier operations I trimmed back each side several inches before finding muscle-fibers, impossible to draw to the median line. In both of these cases I was compelled to suture the wound transversely, and, contrary to my expectation, the results were just as good as in the ordinary manner of suturing.

If the patient be laid on the table and then is requested to rise, the action of the recti will clearly show their position and indicate the feasibility of attempting to draw them together in the median line. In a few cases I have been able to do this, and by tier suturing secured fine results. If the distance be too great, I use the flap method with satisfaction. After removing the umbilicus and attached sac freely, I have cut the ring upward and downward 1 inch or more, and cleared the aponeurotic structures on each side for at least 2 inches.

Mattress sutures of silver wire are introduced 1½ inches from the margin of the aponeurosis on one side, and ¼ inch from the margin on the opposite side; when these are tightened, it draws one side beneath the other, the overlapping edge being sutured to the surface of the opposite aponeurosis. As no sacrifice of tissue has been made, the overlapping is readily done. C. P. Noble uses a somewhat similar method in closing celiotomy incisions.

In operating for umbilical and ventral hernia the suggestion of Joseph Ransohoff, that the incision be carried into the abdomen on either side of the umbilicus and sac, is a good one, as it allows the hernia to be drawn out and inspected from the inner side and saves a tedious dissection. The little ventral hernia above the umbilicus in the median line can be easily closed in a similar manner, and in 8 cases, in the experience of the writer, it has relieved chronic gastric pain of long standing.

Buried silver-wire sutures in the upper part of the abdomen have not given me the after-trouble which I referred to in speaking of their use in inguinal hernia, although I limit the use of non-absorbable sutures to large umbilical and ventral hernia, where tier sutures are clearly inapplicable.

Post-operative Hernia.—From drainage and other causes these hernias cannot be avoided. If of small size, tier suturing has given good results, but if of long standing and considerable size, with attenuated muscle at the margins, the flap or overlapping method, as applied to femoral and umbilical hernia, has proved quick and satisfactory. By this means the scar is divided into halves, and each line of sutures is protected by normal structures. If the nature of the tissue is not good, buried mattress sutures of silver wire, applied after the method of Halsted, give permanency to the closure.

Before operating upon large hernias which are not readily reduced or only partly so, rest in bed, with limited diet for one or two weeks before operation, is a good plan. On several occasions I have seen great distress and even dangerous symptoms follow sudden return of the contents of large hernial sacs to the abdomen. In old men with large inguinal hernias, if the foot of the bed be raised for a week before and a week after the operation, the abdomen becomes accustomed to the presence of the hernial contents before its permanent reposition, and after operation less strain is brought to bear upon the sutures. If there be enlarged prostate, castration can be done at the same time, and relieves the subsequent urinary straining, which not infrequently caused the hernia. In all operations upon this class of cases the removal of considerable quantities of omentum will lessen intra-abdominal tension. Young males with phimosis should be circumcised before leaving the hospital, to prevent straining. On account of the proximity of the wound on the penis to the hernial wound and the increased restlessness of the child, it is not best to do both operations at one time.

We have kept the ordinary hernia cases in bed for three weeks, and have used no mechanical supports afterward. With large umbilical and ventral hernias four weeks in bed has been considered the shortest time advisable, and if the patient is very corpulent, an abdominal supporter is advised. During the past ten years a total of 243 cases have been operated upon (C. H. Mayo and W. J. Mayo). Previous to this time the operations made were entirely for the relief of strangulated hernias, and attempts at a radical cure were crude and unsatisfactory. Of the 243 operations, 180 were made at St. Mary's Hospital; 11 at the first

State Hospital for the Insane at St. Peter, Minn.; 20 at the second State Hospital for the Insane at Rochester, Minn., and 32 cases outside of these institutions. This includes strangulated hernias in which radical cure operations were performed. In the first four years but 39 cases were subjected to operation. Failures were numerous, and it was not until about six years ago that increased experience led to more systematic work.

Since January 1, 1893, an attempt has been made to find out the number of relapses, and while this could not be done with exactness, the sources of error are less in a fixed agricultural community than would be possible in a large city.

Of the 204 cases operated upon in this period, 164 were inguinal, with 5 known relapses; 16 femoral, with no known relapse; 7 umbilical, with 1 known relapse; 8 ventral, with no known relapse; 9 post-operative, with 1 known relapse. In no case was the relapse complete. In this series 1 case of incarcerated femoral hernia in an insane patient at the Rochester Hospital died of external wound-infection. This may have been an autoinfection, as the patient had eaten her feces unless watched for months before the sudden incarceration demanded relief.

One case of inguinal hernia at St. Mary's died of bronchopneumonia during the second week. This wound healed by primary union.

One case of inguinal hernia at the St. Peter Asylum died of uremia from causes not connected with the operation after perfect healing of the wound. There have been no deaths in non-gangrenous hernia.

Reëxaminations of the 31 cases operated upon in the Rochester State Hospital for Insane and the St. Peter Hospital for Insane show that none of these cases relapsed.

FURTHER EXPERIENCE WITH THE VERTICAL OVERLAPPING OPERATION FOR THE RADICAL CURE OF UMBILICAL HERNIA *

WILLIAM J. MAYO

The results of operations for the radical cure of umbilical hernias in adults have, heretofore, not been encouraging. These patients are usually obese, with attenuated abdominal muscles, and the thin, rigid character of the ring does not offer mechanical conditions advantageous to lasting union.

The principles of closure have been the same as for closure after an ordinary abdominal section, the object being to split the fascia at the ring margins laterally until the recti muscles are reached, and then, by a series of buried sutures, to reconstruct the abdominal wall in layers. The defect in this method is the natural separation of the recti muscles at the level of the umbilicus. Below this point the muscular structures are practically in contact, but above there is from ¼ to ¾ inch separation. To bring the recti together in this locality amounts to a muscle transplantation. In a small hernia this muscular approximation is not difficult and is the operation of choice, but in the larger openings, an inch or more in diameter, it is impracticable, and, so far as I have been able to judge, the attenuated muscles, when secured, are not of great value as retentive agents in this variety of hernia. In very corpulent subjects the muscular separation is greater. If such a patient, lying on the back, be directed to rise, bringing into play the recti muscles, the lateral deviation at the level of the umbilicus is easily shown, and in the majority of cases demonstrates the impossibility of bringing them firmly into median

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* Read at the Fifty-fourth Annual Session of the Amer. Med. Assoc. Reprinted from "Jour. Amer. Med. Assoc.," July 25, 1903.

apposition. The strain in these cases is from above downward, rather than laterally. This is well shown by the pendulous abdomen commonly found in very adipose people, in many cases covering the pubes and often the region of the upper thighs. On assuming the recumbent posture the stretched tissues allow of great mobility, and one can often grasp the abdominal wall and overlap a number of inches without difficulty. The fibrous margins of the ring in umbilical hernia usually lie entirely above the juncture of the urachus and the remains of the hypogastric arteries. These latter structures, as they deviate from the midline below, often allow the formation of considerable pouches between them and the urachus, showing their weight-bearing function.

The causation of acquired umbilical hernia can be said to depend on downward traction of the abdominal walls, and their contents brought to bear on a fixed point at the umbilicus, causing separation. Before this takes place there is an increased vertical lengthening of the abdominal wall and also, to a less extent, in a lateral direction.

In a paper* read before the American Academy of Railway Surgeons October 4, 1898, I called attention to the impracticability of covering in the defect with muscle, left by excision of the larger umbilical hernia, and advocated the overlapping of the aponeurotic structures which were already at hand, securing a wide area of adhesions in place of edge-to-edge union. We had then employed this method in 5 cases: in 3 the overlapping was from side to side, and in 2 from above downward. Extensive lateral incisions to find sufficient muscle to make the routine operation described by various writers compelled us, as a matter of necessity, to overlap from above downward in these 2 cases and, to our satisfaction, we found that the parts came together with less tension than when drawn laterally, and time proved that the strength of union was as lasting.

The first of these overlapping operations was done in 1895. We have now performed this operation 35 times, overlapping from side to side 10 times, and 25 times from above downward. There were no deaths. We have found the operation so much easier from above downward that we now employ it exclusively. The majority of these cases have recently been examined and the permanency of cure was most gratifying; in only one case had there been a relapse, and in this one there was merely a boat-shaped stretching. The operation had been done from side to side, and the patient was much relieved from her former condition. So far as we were able to learn, there were no failures when the vertical overlapping had been properly accomplished. In a paper* on this subject, May, 1901, I again called attention to this method. Further experience with the operation, as well as good results in the hands of other members of the profession, has more than ever convinced me of its value. Some of the writers on this subject deplore the poor results of operation for this variety of hernia and speak most disparagingly as to the permanency of cure by any method, and this was previously our experience.

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* "Annals of Surgery," January, 1899.

Today the expectation of cure in these cases approaches that of inguinal hernia. The operation is easily and quickly performed. The steps are as follows:

1. Transverse elliptic incisions are made surrounding the umbilicus and hernia; this is deepened to the base of the hernial protrusion.

2. The surfaces of the aponeurotic structures are carefully cleared 2½ to 3 inches in all directions from the neck of the sac.

3. The fibrous and peritoneal coverings of the hernia are divided in a circular manner at the neck, exposing its contents. If intestinal viscera are present, the adhesions are separated and restitution made. The contained omentum is ligated and removed with the entire sac of the hernia and without tedious dissection of the adherent portion of omenta.

4. An incision is made through the aponeurotic and peritoneal structures of the ring, extending 1 inch or less transversely to each side, and the peritoneum is separated from the under surface of the upper of the two flaps thus formed.

5. Beginning from 2 to 2½ inches above the margin of the upper

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* "Annals of Surgery," August, 1901.

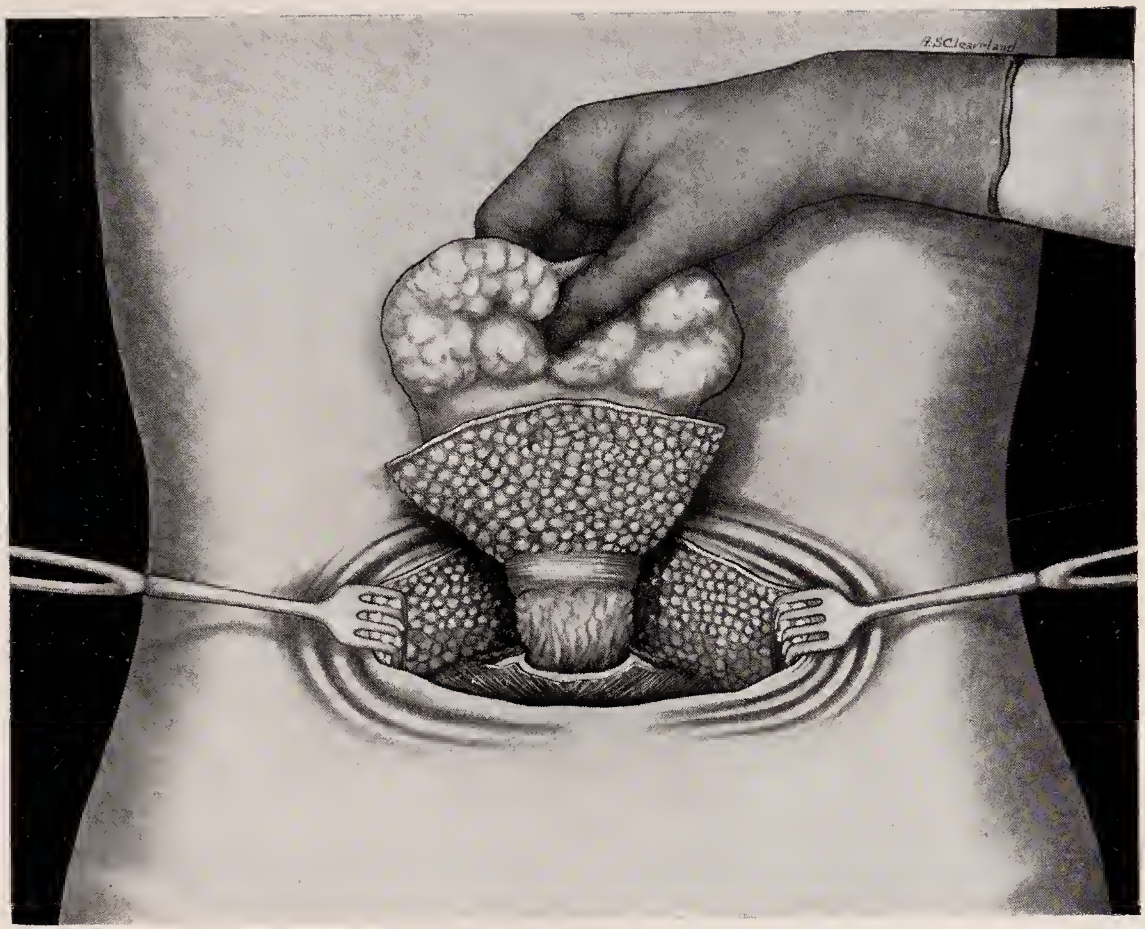

Fig. 47.—Mayo's operation for umbilical hernia.

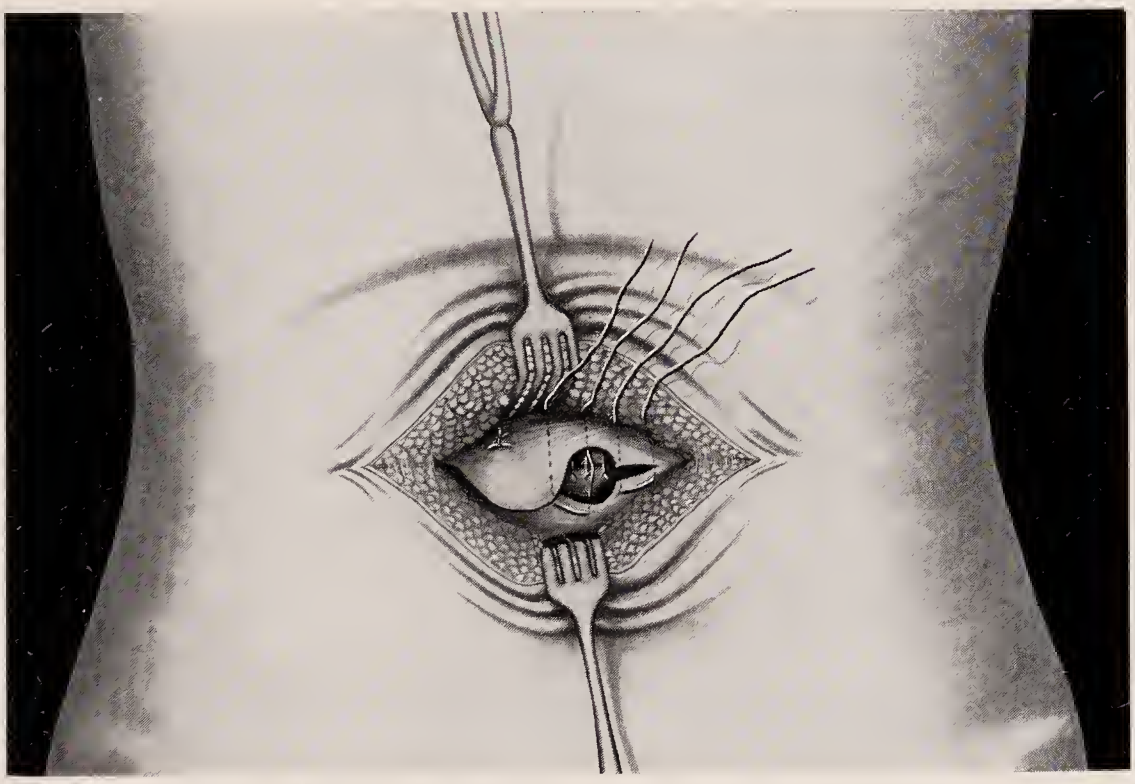

Fig. 48.—Mayo's operation for umbilical hernia, second step.

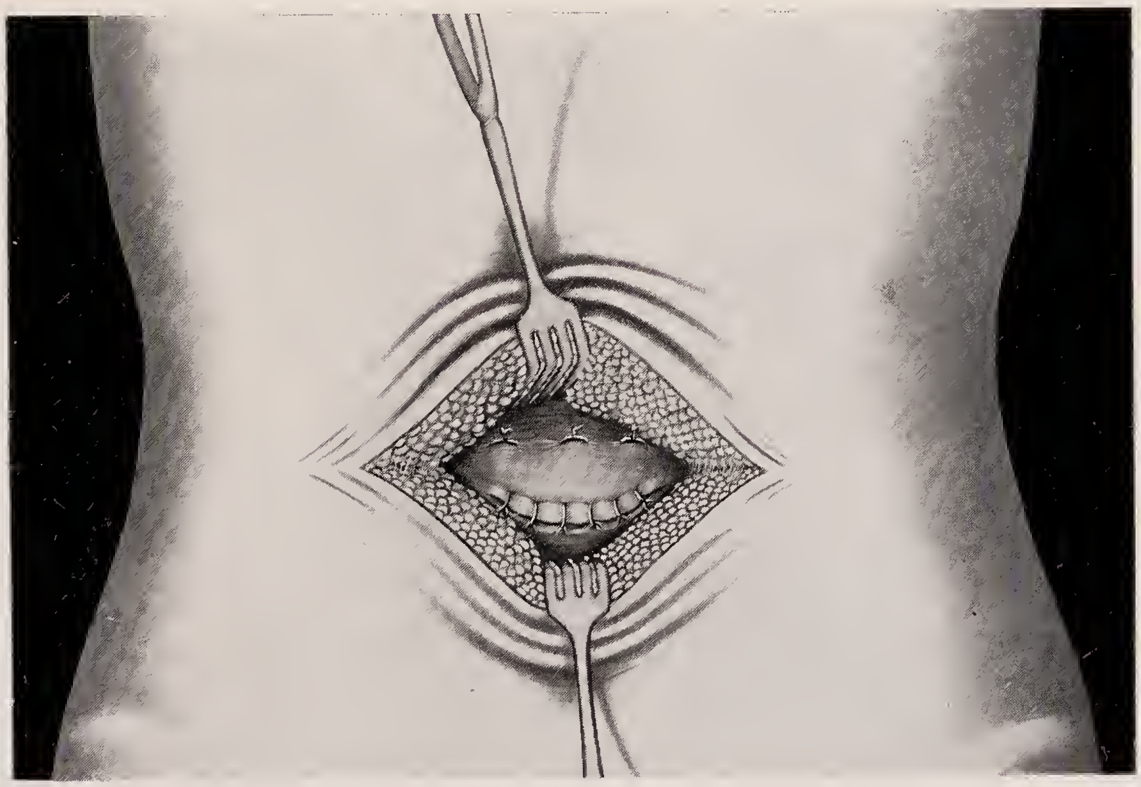

Fig. 49.—Mayo's operation for umbilical hernia, third step.

flap, three or four mattress sutures of silk or other permanent material are introduced, the loop firmly grasping the upper margin of the lower flap; sufficient traction is made on these sutures to enable peritoneal approximation with running suture of catgut. The mattress sutures are then drawn into position, sliding the entire lower flap into the pocket previously formed between the aponeurosis and the peritoneum above.

6. The free margin of the upper flap is fixed by catgut sutures to the surface of the aponeurosis below, and the superficial incision closed in the usual manner. In the larger hernias the incision through the fibrous coverings of the sac may be made somewhat above the base, thereby increasing the amount of tissue to be used in the overlapping process.

In very large protrusions in which part of the hernial contents is irreducible the patient should be kept in bed on a reduced diet and directed to manipulate the hernia, with the intention of replacing as much as possible. The irreducible portion must not be forced into the abdominal cavity after losing the "right of habitation." If the hernia is omentum only, it is readily disposed of by excision; if intestine, enough omentum previously contained in the peritoneal cavity should be removed to allow reduction of the bowel without pressure. The patients should be kept in bed three to four weeks after operation, and, after getting about, should not apply a truss, although most of these patients prefer to wear an abdominal supporter for a year. Piccoli* reports a case successfully operated on in August, 1899, after the lateral plan, and refers to a case reported by Bonomo, operated on December 9, 1899, with a favorable result. J. A. Blake† reports several cases operated on by the lateral method during the year 1900, and refers to an article by Sapiejko,‡ in which a lateral operation is described.

The lateral operation is a good one, but not so good as the vertical method, in which the retaining structures are given a bearing point above the site of the umbilicus, and intra-abdominal pressure thus acts to prevent separation instead of aiding it.

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* Centralbl. f. klin. Chirurgie, January 13, 1900.

† Medical Assoc. of Greater New York, January 14, 1901.

‡ Rev. de Chir., 1900, No. 2, p. 240.

GENITO-URINARY ORGANS

PROSTATIC HYPERTROPHY*

WILLIAM J. MAYO

The prostate is composed of glandular, fibrous, and non-striated muscular tissue. Its base is directed toward the bladder, to which it acts as an involuntary sphincter; as the bladder contracts the urine is forced into the prostatic portion, giving a desire for micturition which is accomplished only by the voluntary act of replacing the cut-off muscle; if the will prohibits, the prostate contracts and forces the urine back into the bladder.

In children the bladder is more nearly an abdominal organ, and the prostate muscle of little power, so that micturition is less voluntary in its control than in adults, but as age advances the bladder sinks lower into the pelvis, and as the support of surrounding organs and muscles becomes weaker, the fundus sinks deeper and deeper, while the neck is attached firmly to the pubes.

Eventually, should the posterior wall of the bladder be on a level with the urinary exit, with a corresponding amount of irritation from residual urine, the desire to urinate becomes more frequent; as this can be resisted by the prostate only, the increased labor gradually produces a hypertrophy which is at first conservative, insomuch as it enable the patient to hold his urine for a longer time.

Speaking of the cause of this sinking of the bladder into the pelvis, Harrison suggests that as man has evolved from a quadruped to a biped, with change to an erect position, the weight of the abdominal viscera falls more directly on the pelvic organs, with displacement of the latter downward by any force weakening their support. This idea may partially account for such troubles as hernia, hemorrhoids, and some uterine displacements. However this may be, it is evident that the bladder becomes irritable and contracts with frequency as a result of partial retention, and not only does the prostate hypertrophy from its extra work, but also as a result of the obstructed circulation and intermitting pressure.

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* Reprinted from "Trans. Minn. State Med. Society," 1889, pp. 39–48.

A common example of intermittent pressure producing hypertrophy is seen in a tight shoe causing a corn, so here a bladder frequently compressing the prostate causes a fibrous enlargement along the lines of the least resistance; this in turn, acting as a foreign body, aggravates the trouble.

For convenience, the prostate is arbitrarily divided into a right and a left lobe; the connecting parts are called the commissures; that part of the posterior commissure lying above the ejaculatory ducts is so frequently enlarged, either as a bar or a distinct growth, that it has been dignified with the name of the third or middle lobe. As a rule, it is this portion of the prostate which gives trouble; any enlargement here acts as a dam to the free exit of urine, with attending decomposition of the residual portion, which develops a cystitis. The violent effort of the bladder to rid itself of the offending urine injures the ureter openings and forces decomposed urine into the ureters, thus extending the inflammation to the kidneys. While, as a rule, these cases are slow in developing, occasionally a temporary paralysis of an overdistended bladder, with acute retention, may precipitate the process, though the majority of such cases shortly recover voluntary power of micturition.

The diagnosis of prostatic hypertrophy, as a rule, is easy. The age of the patient, the gradual increase of the symptoms, are important points; he complains that urination is frequent, more noticeably at night; if he delays, it is slow to start and has but little projectile force, and leaves an unsatisfied feeling. He may tell of hemorrhages and of pain deep seated or in the glans penis; symptoms of chronic cystitis are always present more or less, and in many cases phosphatic stones are the result of the fermentation.

The physical examination through the rectum is of some value in showing the size of the prostate and the probable length of the prostatic urethra, but information of the greatest value is obtained by means of urethral instruments. The most important sign is obstruction to free catheterization, and if this exists, is it due to enlargement of the third lobe, is it lateral, or are there merely increased length and exaggerated curve of the prostatic urethra? Such information is readily obtained by noting the shape and length of the curve of the proper instrument and the direction necessary to glide the tip over or around the obstruction. The amount of chronic retention should also be obtained by passing a catheter into the bladder immediately after urination and measuring the urine siphoned off.

In cases of long standing, during the examination of the interior of the bladder by the sound, we have noted with what ease the tip could be engaged in the mouth of the ureter, giving the "feel" of a fibrous band. We have had no experience with the cystoscope in diagnosis. The prognosis varies with the physical condition present, but the frequently resulting interstitial nephritis should always be borne in mind, and it is probable that this form of Bright's disease, as a result of prostatic enlargement, is much more common than is generally believed. A fatal termination is often due to the exhaustion from chronic cystitis or intercurrent disease acting on an enfeebled constitution.

Treatment naturally divides itself into palliative and radical. Palliative treatment attempts to protect the system from the absorption of poisonous extracts, and to relieve the partial retention, with the cystitis and its attendant dangers. The character of the urine itself, under these circumstances, is of importance, and is now pretty well understood. Acid urine is usually free from germs and toxic extracts, and patients in whom acidity prevails will often live in comparative comfort, but sooner or later the introduction of germs, with attendant decomposition of urine and development of ptomains, suddenly aggravates the previous symptoms, with danger of urinary fever from absorption through any abrasion of the epithelium. These abrasions are often caused by instrumentation, but may result from the forcible contractions acting on the enlarged and congested prostate, allowing infiltration of urine, and is followed by development of cicatricial tissue, just as a stricture is formed, with increase of the original difficulty.

Urinary fever, with its attending rigors and sweats, is a slight uremic attack, and often accompanied by mental aberration, usually of a mild character, marked by great restlessness, talkativeness, and inability to fix the attention on any subject for the briefest period. It resembles, in some respects, the more maniacal insanity seen after surgical operations, especially in the old. Quinin seems to have some value in relieving the system of such toxic effects, and undoubtedly acts on the urine itself. Benzoic acid also aids in rendering the urine more acid.

Before taking up chronic partial retention I would remark that acute retention, in our experience, is most frequently caused by prolonged voluntary retention and exposure to cold; also that in rare instances, when careful manipulation failed to pass the obstruction, immediately after aspiration had been practised a catheter could be entered during relaxation, and under such circumstances should be tied in place, as in a short time catheterization may again be impossible.

In chronic retention it is evident that if prolonged voluntary retention acts to cause hypertrophy, patients should never hold the urine long, and, as a rule, regular catheterization with an aseptic instrument is the main feature of treatment. The frequency of catheterization depends on the condition of the urine and the amount of retention; in severe cases it should be drawn every six hours. The cystitis should be carefully treated by washing out the bladder with antiseptics and astringent solutions. The diet should be liberal and the body warmly clad, and during acute exacerbation sufficient opium, hyoscyamus, etc., administered to relieve pain. It is important that the bowels should act daily, and for this purpose rectal injections of glycerin are of much value in relieving local congestion.

To the rule of regular catheterization there are a few important exceptions:

1. When the partial retention is either overcome by bladder contraction or is well borne, the urine being sufficiently acid to

prevent decomposition and cystitis. Here frequent catheterization is not only unnecessary, but a constant source of danger from infection. Hydrostatic dilatation in such cases is often of great value, and is easily carried out by the patient compressing the glans penis for a brief period during micturition; the urine, suddenly dammed, acts as a dilator. If the symptoms increase, the use of the catheter may begin at bedtime, and should there be any difficulty in catheterization, gradual dilatation by sounds will be useful.

2. In the second class we find a thickened bladder of little contractile power, often presenting a well-marked tumor in the lower abdomen, while the amount of retention is large; many of these cases also present symptoms of interstitial nephritis or a surgical kidney. The long-continued cystitis has developed so much cicatricial tissue that even if the bladder should be entirely emptied, it has lost the power of complete contraction and may not even collapse, so that catheterization must be employed with great caution at first, and followed by irrigation with antiseptic solutions; even then it may be badly borne and require operation. Complete retention should not be entirely relieved at once, as such practice is often followed by acute cystitis and more rarely by uremia, suppression of urine, and death. Strychnin is indicated for this atonic condition.

3. The third exception is when we have no choice, and operative procedures are not only justifiable, but often demanded as the only resource, namely, when catheterization is impossible or so difficult as to be a constant source of danger of forming false passages or so bruising the prostatic enlargement as to increase the obstruction and give rise to frequent attacks of fever. In this condition the third lobe plays an important part, and is often the sole cause of trouble.

There are two important factors in view of operation—drainage and removal of the obstructing part if possible. The method practised by some European surgeons, notably by Dittel, of suprapubic puncture with the trocar and the retention of the cannula, fulfils the factor of drainage. The danger of urinary infiltration is probably greater in this than in suprapubic cystotomy, while it gives no opportunity for further exploration. Its use in chronic partial retention is deservedly unpopular, but in a case of acute complete retention supervening upon chronic partial retention, when catheterization is impossible and the patient situated at such a distance as to render aspiration of insufficient frequency, this method may be of the greatest value for temporary service. Cock's method of puncture through the rectum, as well as perineal puncture, is more difficult of execution and has no especial advantages.

Much ingenuity has been expended in contriving instruments for attack upon the prostate by the urethra; these operations are blind, consequently impracticable, and lack the essential element—that of drainage. Mercier's method and instruments are best known. As usual, electricity, with its occult power, has been called to aid the solution of the problem. The most that can be said in its favor is that it pays—the physician. Parenchymatous injection into the gland of iodin, iodoform, ergot, etc., has been frequently tried, but it is difficult to separate the actual benefit of such practice from other measures of relief used. We have no experience with this method.

There are two methods of attack on the bladder that fulfil ideal conditions, each giving satisfactory drainage and furnishing opportunity for removal of the obstructing portion if deemed advisable, namely, suprapubic and perineal cystotomy. Theoretically, it would seem that drainage after perineal operation would be much better than from the suprapubic method, but practically this is not true, as the bladder is a contractile organ, and in these cases, as a rule, is unusually muscular and assisted by intra-abdominal pressure. The relief obtained to the inflamed viscus is as certain and immediate in the latter as in the former method. It has this great advantage, that if it should be necessary to allow the fistulous opening to remain, a certain amount of continence is retained and urine can be voided by voluntary effort, while after the perineal operation incontinence is at once established. Whitehead, of Manchester, attempts to avoid this condition by making his exploration through the perineum into the urethra in front of the bladder, and after digitally exploring its cavity, should further operation be deemed inadvisable, this fistulous tract is retained for a short catheter route.

I cannot conceive that this would be a satisfactory condition of things. As to the relative advantage as a means of exploration and operation upon the interior of the bladder, the suprapubic opening is far superior; it is astonishing with what ease such examination can be made and operation performed. But in my estimation the greatest advantage of the suprapubic operation is the fact that, by entirely relieving the urethra of its function as a channel, the muscular prostate will atrophy from disuse, and the fibrous portion will undergo the same process as a result of checking the intermittent pressure which acted as its cause, so that many cases not amenable to safe operation will by this simple opening be given temporary relief at once, and after a time may regain power of urination or enter upon a comfortable catheter life. If what Hunter McGuire calls his "teapot" operation be made, that is, a low opening into the bladder sutured to the highest point in the external incision, so that the fistulous tract will sustain the same relation to the bladder as a spout to the teapot, continence for some hours is readily obtained.

A contracted bladder renders the suprapubic operation difficult, but in testing the capacity I would urge that it be done under anesthesia, as without it a bladder irritable from prolonged inflammation will tolerate so little fluid as to indicate a contraction which does not exist. On the contrary, a greatly elongated prostatic urethra is a contraindication to the perineal operation, as shown in a recent paper by Watson. While he favors the perineal operation, he conclusively shows that a perineal depth of over a finger's length does not allow of accurate work. For the methods of making these operations and dealing with the offending obstruction ample directions are given in late works on surgery.

From personal experience I can testify to the ease with which suprapubic cystotomy can be made, though the perineal operation presents no special difficulties under normal conditions. While out of place in this connection, I would add that in one or two instances of injury to the perineum a blind hunt in the disorganized tissues for the ruptured urethra has been happily terminated by suprapubic opening, and a guide furnished by reversing the direction of a sound from the bladder into the urethra. As a surgical curiosity it is worthy of note that the prostate gland has been entirely removed by means of an opening made by separating the pubic bones. This procedure, like Langenbeck's, above the penis and just under the pubic arch, is open to the objection of "too much operation."

THE IMPORTANCE OF UTERINE DRAINAGE *

WILLIAM J. MAYO

The importance of uterine drainage has not, I believe, been as fully recognized by the medical profession as its value deserves. Drainage, as a principle of general surgery, is an essential factor in aseptic wounds, while in the treatment of suppuration or of discharging cavities its utility has been unquestioned for years. The thorough application of the method by the gynecologist has been of more recent date, and to its aid many of the advances in surgery of the diseases of women owe their existence. I can well believe the remark made by one of our old and honored surgeons, that the uterine sound had caused more harm than good, not, as he thought, that the injuries it inflicted upon the interior of the uterus started up a cellulitis, but, as we know today, that germs were carried into a diseased cavity which furnished a suitable soil for the development of a septic endometritis, while no adequate drainage was established whereby the inflammatory products could escape. We can readily believe that the dilator would have been much safer, allowing ready escape to the poisonous secretions, and the danger of extension by means of the tubes to the peritoneum have been materially lessened. Endometritis, either alone or as a complication is one of the most common diseases from which women suffer. In its chronic form it presents a clinical picture with which we are all only too familiar. Not only is the health undermined by systemic absorption of morbid materials, but there is the ever-present danger of extension to the tubes, with

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* Read before the Department of Diseases of Women of the Minnesota State Medical Society, June 20, 1890. Reprinted from "Northwestern Lancet," September 5, 1890.

slow or doubtful recovery. By the aid of the dilator not only are we able to drain away the noxious discharges, but we gain free access to the interior of the uterus, and by means of the curet, carbolic acid, or other topical applications, attack the seat of disease. For this purpose in severe cases the curet has not received the attention it merits as a safe and effective means of removing diseased tissue.

In aiding drainage, glycerin tampons have a deserved popularity, and by absorbing fluids from the congested tissues assist in restoring normal circulation. Wylie's hard-rubber intra-uterine drainage plugs and iodoform gauze have each their advocates, but it is not likely that their use will become general.

Should the disease have extended to the tubes, the dilator must not be used until all acute symptoms of salpingitis have disappeared, not that its value to the endometritis is less, but because the process in the appendages is more important, and in the impossibility of establishing free drainage for the inflammatory products of a salpingitis lies the true cause of its tedious treatment, many times rendering laparotomy necessary for the relief of chronic invalidism or causing death from septic complication.

It is altogether probable that malpositions of the uterus cause more harm by obstructing free drainage than by the mechanical effects of position. How often do we see a flexion or a version causing little trouble as long as the cervical canal is freely open. I fully believe that the little good done by vaginal pessaries is in restoring the caliber of a bent canal, or by bringing gravity to aid in draining a retroverted fundus. Many displacements depend upon disease in the uterine appendages, and the symptoms are due to this complication, rather than to the situation of the uterus.

We not infrequently see uteri distorted by fibroids causing small local symptoms until an endometritis complicates the difficulty, and the distress relieved by the dilator and curet, independent of the changed shape of the uterus.

Stem pessaries are of value in anteflexions by straightening the canal and restoring its caliber. In some obstinate cases of anteflexion which have relapsed after dilatation I have had surprisingly good results from divulsion followed by an intra-uterine stem until the channel has reformed. For the purpose of restoring the cervical canal tents have long been employed; they have the disadvantage of temporarily checking drainage and exciting uterine contractions, which may force secretions into the tubes, thus extending the mischief. This reason, as well as the more perfect control over the steel dilator, has caused it to supersede tents for this purpose to a great extent.

In acute endometritis the result of parturition or abortion the dilator and the curet are the means of saving many lives and much suffering.

In acute gonorrheal endometritis the dilator must be used with great care for fear of extending the disease or causing mixed infection, but in subacute and chronic cases it has much value in aiding treatment.

In conclusion, I would urge the necessity for antiseptic precautions in all intra-uterine manipulation, and believe that by great care in this particular we avoid the chief danger.

A DISCUSSION OF SOME FEATURES OF PERI-UTERINE AND PERITYPHLITIC ABSCESSES *

WILLIAM J. MAYO

It is not my intention to enter into an exhaustive discussion of septic processes in the peritoneal cavity, but rather to detail my own observations, drawn from a considerable number of cases, 16 of which were operated upon during the last two years.

At the first glance it would seem that there was little similarity between peri-uterine and perityphlitic abscesses, but we must recollect that for years the average practitioner has satisfied himself with the general diagnosis of "inflammation of the bowels" in either case, and too frequently left the result to nature, and that these two forms of septic infection comprise at least 90 per cent. or more of all cases of septic peritonitis not surgical. Again, when we observe that the most intelligent practitioner considered that the inflammatory process started in the cellular tissues in some mysterious manner, so-called idiopathic, and in fatal cases only burst into the peritoneal cavity, in other words, that they were forms of cellulitis, and in the careful dissection of the connective-tissue planes, which are of about as much value to the surgeon as the hernial layers, we have enough to show that the subject was considered of the utmost importance. But today we know that these conditions are intraperitoneal from their inception, and simply manifestations of local sepsis which may undergo exactly the same changes as elsewhere in the body, namely, absorption, encapsulation, and extrusion, or a combination of these processes. Viewed in this light, we find that each represents a weak point in

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* Read before the Minnesota Academy of Medicine, May 3, 1890. Reprinted from "Northwestern Lancet," June 1, 1890.

nature's abdominal protection. The tube directly connects the peritoneum with the outside world, but through at least one aseptic medium, the uterine cavity, which in a normal state has been demonstrated to be free from germs. Let this cavity become septic, and we need not stretch our imagination by thinking that the cellular tissue about the uterus becomes inflamed, as here is a channel of communication which may conduct septic material from the uterus into the peritoneal cavity as easily as the ova from the abdominal cavity to the uterus. Herein lies the danger of the dirty sound, the retained placental fragments, and uterine injuries or gonorrheal endometritis. Careful examination leads us to consider it almost a question of dosage of a septic poison, which may be so slight as to produce merely a salpingitis, or so massive as to render nature unable to inclose it in adhesions, with a rapidly fatal termination.

I will not discuss the pathology of tubal inflammations, but before leaving this part of the subject would like to call attention to the mechanical advantages afforded nature in her attempts to encapsulate the septic poison should the tube drip its contents back of the broad ligament into Douglas' culdesac, while should the tube incline forward of this ligament, its contents must lie in a narrow space, which is constantly changing its position as the bladder is full or empty, and largely increase the liability of diffusion. In the former case nature can more easily spontaneously evacuate into the vagina or rectum. Some time ago, in making an autopsy on a rapidly progressing case of peritonitis the result of an abortion, I found the original pocket on the anterior shelf. Since then, in 2 cases out of 3 of such severity as to require abdominal sections as the only hope of a good result, a like condition was observed. In this connection I would call attention to the great value of uterine drainage in preventing peritoneal infection in cases of septic endometritis.

In pericecal inflammations the appendix plays the important part that the tube plays in the peri-uterine inflammations. Until of late the ability of the peritoneum rapidly to encapsulate septic material has never been dreamed of. As an anatomic fact it was known that both the cecum and its appendix were surrounded by peritoneum; still it was supposed that a mysterious dispensation cast the inflammation into the cellular tissue; that this was an error it is hardly necessary for me to say. In the majority of the 10 operations for this variety of abscess I was able to demonstrate, to the satisfaction of all present, that the abscess was in the peritoneal cavity, and that the intestines, agglutinated by plastic adhesions, formed the inner wall of the abscess; not only that, but in many cases the appearance and color of the plastic exudate over their surfaces showed the difference in length of time the particular loop of intestine had been exposed to the infection, giving what might be termed a mosaic appearance, and one could realize that every time an extension took place constitutional symptoms followed which largely subsided as the part became adherent. The mechanical situation of the appendix favors the view that appendicitis is most frequently caused by the gravitation of foreign bodies into it, and thus it becomes literally a death-trap. I am convinced, however, that to a certain extent this is an error, and believe many of the supposed foreign bodies to be fecoliths, a fine specimen of which I have the pleasure of presenting to you. While, as a rule, the abscess under discussion enlarges upward and outward toward Poupart's ligament, it may be influenced by the length and direction of the appendix, its relation to the mesentery and longitudinal bands of the great intestine; their resistance may divert its course, and extensive dissection be required to find its location.

The pathologic changes in the development of a pericecal abscess from an ulcerative appendicitis may be aptly compared to a pus-tube as a cause of pelvic abscess—either may rupture its way into the organ with which it has normal communication, and in either case relapses are common; or the rupture may open into the peritoneal cavity, more commonly to become encapsulated and form a secondary abscess, which in turn may adhere and discharge into some organ having an external exit; but, as a rule, surgical measures are demanded lest a more or less rapid extension into a general fatal peritonitis be started.

In several autopsies where death has resulted from progressive suppurative peritonitis I have noticed a number of small pockets of encapsulated pus, in advance, so to speak, of the general abscess cavity, although at least one-half or more of the peritoneum was involved. In some cases operated on I noticed the same phenomena. This led me, in a desperate case of general septic peritonitis as the result of an internal rupture of a perityphlitic abscess, to pass large drainage-tubes from the liberal lateral incision in every direction and trust to free drainage without irrigation, fearing that the latter, if done with any degree of thoroughness, might rupture adhesions and spread the infection, if not already complete. The result was excellent.

As a rule, however, we find but a single large pocket, well protected, and careful irrigation is of value. The fact should be borne in mind in urging an operation that these abscesses may and often do terminate by a natural opening with spontaneous recovery, and for anatomic and mechanical reasons this is especially true of pelvic abscesses. Such fortunate termination, however, should not be relied upon, and a timely operation is one of the triumphs of surgery in many otherwise hopeless cases. When to operate is a question which taxes the judgment of the surgeon; as a rule, in perityphlitic abscess, adhesions may limit the pocket of pus and make an operation timely from the fourth to the eighth day, depending upon the condition of the patient. One must, however, be ready to operate any time when rapidly progressing symptoms develop. The lateral incision is by all means the most practicable one.

In pelvic abscesses there is much greater latitude in length of time; massive septic infection, involving so much of the peritoneal cavity as to amount to a rapidly progressive peritonitis, must be heroically treated by early operation as the only chance of success. But many of these abscesses are slow in developing, and a favorable time may be chosen for an attack by the vagina or an external incision over the long axis of the tumor. In operating, should we penetrate within the line of adhesion, we may introduce the finger and explore for a situation more protected for opening; if this be possible, the small opening can be sutured and the operation continued. Should this be impracticable, the abscess-sac can be partially emptied by aspiration, to get what is ordinarily called "slack," to enable us safely to suture it into the incision and protect the healthy peritoneum before opening.

In the chronic abscess it should be borne in mind that we have symptoms of sepsis in a mild form only, and a large encapsulated abscess may give small signs of fever and chills; in fact, it may be said, as a rule, that hectic, as shown by fever, chills, and sweating, means extension.

The cathartic treatment, so successful in general peritonitis, is entirely unsuited to the local form, and may, by breaking up adhesions, precipitate a fatal result. The hypodermic needle is the only positive sign of pus, but it does not have negative value.

In the 10 cases of perityphlitic abscess, including the successful operation for general suppurative peritonitis, 9 were wholly successful; the tenth died from a complication three weeks after the operation. Of the 6 cases of pelvic abscess seen during 1889, all were successful. Three were treated by abdominal section and 3 by vaginal puncture.*

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* Since writing this paper I have operated on two additional cases of pelvic abscess, with a successful result in both instances. One of these does not fairly belong to the class of cases which compose this paper, being a suppurative extra-peritoneal hematocele of the broad ligament. The second case was caused by the rupture of a pyosalpinx into the cavity of the broad ligament. This latter case is a very interesting one, showing the laceration of the cervix six years ago, followed by endometritis, with extension to the right tube of a septic inflammation, and causing chronic invalidism, for which laparotomy was proposed and rejected one year ago. Two months ago the symptoms became acute and this variety of abscess followed.

ARTIFICIAL PROLAPSE AS AN AID TO DIAGNOSIS: CERTAIN OPERATIONS ON THE UTERUS AND VAGINA *

WILLIAM J. MAYO

Artificial prolapse of the uterus, to or through the vulva, with the patient in the dorsal position, has long been a recognized procedure among European surgeons, but in this country it has to a large extent been overlooked or viewed with disfavor. Sims' position in the treatment of the inflammatory diseases of the uterus is unrivaled, gravity aiding to restore the uterus to a higher level, relieving overstretched supports, and allowing the congested vessels to drain readily. Operation in this position can be easily accomplished by instrumental means, but the direct use of the fingers is largely lost. In this position downward traction on the uterus, of moderate amount, will draw the cervix into the grasp of the levator ani muscle, which acts as a diaphragm between the outer muscular portion of the vagina and the upper distended part; and such increased accessibility is more than counterbalanced by the limited working space.

On the back, with the thighs flexed well against the abdomen, as in the attitude of defecation, the same amount of traction will draw the cervix to the vulva, and operation can be made either upon the uterus or upper vagina with the ease of an external part. Practically speaking, Sims' position carries the uterus away from the operator's hand, while in the dorsal position, with the thighs well flexed, descent of the organ is apparent to a marked degree, and in many cases lacerations of the pelvic floor render trac-

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* Read before the Department of Gyneeology of the Minnesota State Medical Society, June 19, 1891. Reprinted from the "Northwestern Lancet," September 15, 1891.

tion, other than steadying, entirely unnecessary. The tension straightens out the tortuous vessels, thus diminishing the hemorrhage and operations about the uterine cavity, cervix, and vagina can be carried on with few instruments and under constant irrigation, in place of sponges, while the position is also suitable for operations on the perineum.

Catgut sutures may be inserted and tied, with obvious advantage over wire. Volsella or the double thread may be used to draw the uterus down and hold it. The speculum used is a perineal retractor—some modification of Martin's. The Marcy-Martin is a favorite with me, as the hollow handle carries off the irrigating fluid, while the hook at the lower end rests the assistant's hand, and the weight of the arm exerts the force needed fully to expand the lower vagina and expose the field. The assistant sits at one side, on a low stool, out of the way. Cushing uses a speculum constructed of lead pipe of sufficient weight to act as a posterior retractor. Edebohls also has a most excellent modification. The patient's lower limbs may be held in position by an assistant or by a crutch, which I prefer.

As a means of diagnosis the dorsal position is universally used, for the plain reason that it renders the parts accessible to the touch, and whenever the hand depresses the uterus externally, it amounts to an artificial prolapse. In certain instances where this cannot be done without anesthesia by reason of muscular tension in the abdominal walls or excessive adipose tissue, the anterior lip of the uterus can be caught with a tenaculum, the uterus drawn down, and diagnosis facilitated by vaginal and rectal touch, or the cavity of the uterus digitally explored after dilatation. In this manner particularly the ovaries and tubes may be examined with increased ease. As a tractor, a Sims' uterine repositor is often of great value in keeping the uterus anteverted, drawing it forward as well as downward, materially assisting us to differentiate between the uterus and its growths and other enlargements in its immediate vicinity. When used in this manner, strict antiseptic precautions must be observed.

The objections urged against artificial prolapse are, first, the danger of tearing adhesions or rupturing a pyosalpinx. I can only say that these conditions can be readily diagnosed, as a rule, without instrumental means, and, where necessary to aid diagnosis without an anesthetic, dangerous traction would not be borne by the patient nor permitted by a careful surgeon; certainly no operation would be safe either after this manner or any other, and even if accomplished, would be valueless as a means of relief to the patient. Laparotomy in such cases would be indicated.

The second objection, that it overstretches the ligaments and pulls the cervix out of shape, can be made only by one who has either tried it in lateral position or who speaks from theoretic knowledge only. The few serious results that have been urged as evidences of danger can be multiplied by equally bad results in the ordinary method of operating, and are due, in either case, to imperfect diagnosis of diseased appendages or to faulty antiseptic detail.

I have used this method constantly in both hospital and private practice for over two years, and am convinced that unprejudiced observation will show its superiority in the large majority of so-called minor gynecologic operations, with not only a great saving of time, but by enlarging the working field, it permits more accurate manipulation, with perfect use of the eyes and hands.

THE QUESTION OF THE REMOVAL OF THE OVARIES AND TUBES FOR CHRONIC DISEASE*

WILLIAM J. MAYO

Current literature of late has been filled with sneers at Battey's operation,—normal ovariotomy for nervous phenomena,—and much distrust is also expressed as to the frequent necessity for the operation of Tait—the removal of chronically inflamed uterine appendages. Unfortunately for the credit of the laparotomist, the distinction between these entirely different procedures, from a pathologic standpoint, is not clearly understood by the general practitioner, and much confusion has been the result. The necessity for operation to relieve gross pathologic lesions, such as ovarian and other tumors involving the ovaries and tubes, as well as acute suppurative processes of these organs, and to check the growth of multinodular fibroids of the uterus, has been too well established to admit of discussion; but the expediency of removal for ovaritis, salpingitis, and pelvic peritonitis has been questioned, while normal ovariotomy for nervous diseases has been challenged by high authority.

Much of the unjust criticism heaped upon the head of the operator has been due to the fact that the nervous symptoms frequently exhibited by the patient, with actual structural disease of the appendages, and due to such disease, often have apparent similarity to hysteric and other manifestations of a diseased nervous system with normal ovaries and tubes. For a fair discussion of this problem these two groups of cases must be separated, and we will first consider that limited number of cases in which the ovaries and tubes are either normal or too slightly diseased of themselves to require removal, but wherein nervous phenomena, more or less associated with menstruation, have demanded the sacrifice.

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* Read before the Department of Gynecology of the Minnesota State Medical Society, June 17, 1892. Reprinted from the "Northwestern Lancet," July 1, 1892.

Normal ovariotomy, then, in legitimate cases, must have for its central event and idea the production of the menopause. According to the statistics of Hegar, Lusk, and others, this result may be expected in 84 per cent. of the cases operated upon. Failure in this respect may be due to incomplete operation, since it has been shown by Johnstone that the controlling nerve-center lies close to the uterine end of the tube.

J. Bland-Sutton has pointed out that coincident disease in the uterus may often account for a bloody discharge, which is not a true menstruation. In particular this thorough pathologist combats the idea of the existence of a third ovary, and asserts its nonexistence upon unimpeachable evidence.

This operation has been done for the relief of a host of nervous affections, such as insanity, hystero-epilepsy, neurasthenia, dysmenorrhea, etc. The part played by diseases of the female generative organs in the etiology of insanity has undoubtedly been greatly overestimated. In a recent paper by Dr. Sara Linton, read before the Olmsted County Medical Society, the results of her own observation in the Minnesota Hospital for the Insane at Rochester are given, and also the information obtained by a large correspondence with others holding similar positions in insane hospitals. The conclusion drawn from this extensive investigation was that serious disease of the genital apparatus was but little if any more frequent among female insane than among the same number of sane. Castration for the relief of insanity, hysteria, etc., can be justified only on Malthusian principles, and mutilation of the mentally afflicted, even for this purpose, would not equal Carlyle's suggestion of spending three days in the year exterminating able-bodied paupers.

Charcot, with his enormous experience, says that he does not know of a single instance where success has attended the operation when done for this purpose. For the relief of dysmenorrhea, according to Champneys, it is usually a failure unless the painful menstruation is caused by actual disease of the appendages, while

Lusk, in a recent paper before the American Gynecological Association, dismisses the subject by saying that normal ovariotomy for nervous affections is malpractice. A few good results have been obtained by Mundé, Boldt, Goodell, and others in pure examples of hystero-epilepsy, and in a recent able paper by Wheaton on osteomalacia he reported a few recorded cases where removal of the ovaries had been of great benefit. To sum up, it may be said that normal ovariotomy should be undertaken only after most careful consideration of all the facts and consultation with the neurologist.

The Removal of the Ovaries and Tubes for Disease

My time is too short to go into the pathology of the diseases of the ovaries and tubes, but I will refer you to the works of Tait, Martin, Pozzi, and Price, and especially to the late work of J. Bland-Sutton. It may be said, in passing, that the class of cases referred to are those technically called oöphorosalpingitis and perimetrosalpingitis, almost always originating in an endometritis, the latter being due to a septic or gonorrheal infection, or, more rarely, having a tuberculous origin. This inflammation extends, by means of the tubes, to the pelvic peritoneum, except in puerperal cases, in which class the lymphatics may play an important part as carriers of infection.

The removal of the appendages for chronic disease has been opposed by so-called conservative men, and, to tell the truth, in many instances the problem is a most perplexing one. In other words, how much disease does it require to render operation necessary?

Coe says that with an ovary in the hand it is often difficult to tell whether it is functionally useless or not. How much more so then before the operation! Upon this point Lee remarked, before the New York Academy, that many men were better operators than diagnosticians, and it must be confessed that too often the objective signs of disease are small and the subjective symptoms of the patient great, and no improvement to the coincident neurasthenia follows operation.

In deciding for or against operation, certain other factors must be considered, for instance, the station in life of the patient. Those in affluent circumstances, with opportunity to devote much care to their condition, would require operation relatively less frequently than the poor classes, other things being equal. Something, too, depends upon the individual skill of the operator.

The uncertainty of the ultimate results in a given case of oöphorosalpingitis does not depend, as a rule, so much upon the difficulty of relief of the local trouble, as upon the uncertainty that the symptoms are due to the pelvic condition, and also whether such an effect has been made upon the nerve-centers that cure is impossible under any circumstances. An accurate diagnosis, then, is of the utmost importance. Upon this question Wylie says that as he improves as a diagnostician he becomes less conservative and more successful; and this view is sustained by Tait, Price, Martin, and a host of others. On the contrary, Reamy gives the results of 164 operations in a paper before the American Gynecological Association at its last meeting, and intimates that, upon the whole, the results were disappointing; and like opinions are expressed in late papers by Lee, Lusk, and Ross. A careful investigation of this subject leads one to believe that the gravity of the operation has led many men to expect too much or to operate too late. It will be well to consider some of the objections in detail.

1. Immediate mortality. As in competent hands this is not greater than from 2 to 6 per cent., it would seem that in suitable cases the benefits would exceed the dangers. It is also urged that the operation itself, if not fatal, may leave the patient in worse condition—for example, with hernia, which has been estimated to follow in 10 per cent. of cases. Wylie long ago pointed out that the abdominal cavity in its coverings differed from a hernial sac only by the presence of muscle and tendon, and that accurate suture of these structures would prevent its occurrence. In my experience this has been true. We are indebted to Coe for his investigations into the subject of secondary adhesions of the omentum and intestines as a cause of bad results. Price believed that irrigation acts to prevent this, and Morris attempts to cover

denuded surfaces with a film of aristol. A second operation may be necessary for their liberation. Fecal and urinary fistulas may follow. Tait, in his unrivaled experience, has often met with this result, and states that, as a rule, they close spontaneously, and if not, methods of dealing with them have been successfully instituted. Many cases of fecal fistula have been cured by means of Senn's bone plates, also by Abbe's method of lateral anastomosis by means of continuous sutures, and Dudley and McLaren report cures by means of direct suture of the bowel opening. Under any circumstances operative accidents are not confined to this branch of surgery, and will grow less with added experience and improved technic.

2. An important objection is the sterilization of the woman. The ready answer is that in cases suitable for operation the disease has already done this. Certainly the operation should not be blamed for the lack of judgment of individual operators. In the "American Journal of Obstetrics," October, 1891, Polk records 50 cases of conservative surgery as applied to the ovaries and tubes; it is to be hoped that this work will be continued. On the whole, however, the general experience has been that in operating for chronic pelvic disease it is better to remove both appendages, as it has been shown that a second operation too often becomes necessary should this not be done.

3. A woman becomes changed physically and mentally, that she develops mannish traits, loses her sexual desire, and may go insane. As to the physical change in an adult woman, Sutton says: "Until puberty the sexes are little separated in sexual characteristics—merely an anatomic difference. If castration be performed in either case, sexual differentiation fails thoroughly to develop, and they retain their primitive features; but when once developed, the effect in the female of the operation is to produce the menopause," and with this opinion all thinking men agree. Much discussion as to the effect on the sexual appetite has been indulged in; as the pelvic pain in most instances has rendered coition unendurable before the operation, so it has been said to restore rather than to destroy. Reamy, Lee, Martin, and others have investigated this matter as fully as possible, but the

results have been uncertain, depending much upon the previous condition and age of the patient. Reliable information upon this question has not been obtained in sufficient amount to draw conclusions. It is probable that in removing painful appendages it will restore, at least for a time, but it is equally certain that atrophy following the menopause will abate, if not abolish, sexual feeling, as under normal conditions. In young married women Wylie states that this hyperesthesia of the genitals often follows, and says that this may be prevented by leaving a small piece of the ovary in suitable cases. Upon this point Polk remarks that the younger the patient, the less the chances of cure. It has been charged that such operation may cause insanity. It can be said that this fear is groundless. Baldy and Leidy have carefully investigated this matter and have compiled statistics which refute the idea entirely. Many cases "queer" at the time of operation have afterward become insane, but this simply proves that the operation failed to prevent, not that it caused, this result.

4. It is said that a very large percentage of cases after the pelvis has been cleared of disease are no better, and that a recovery from the immediate operation does not mean final cure. Upon this question Tait says that a year must elapse before failure to relieve is manifest, and patients apparently worse during the first twelve months have merely gone through the nervous phenomena often found at the change of life. Pilcher remarks on the failure of the operation to relieve, and that perhaps the most frequent cause is the fact that the pelvic disease was not the cause of the symptoms. It must not be forgotten that the accompanying endometritis gives rise to much of the patient's discomfort, and that the removal of the diseased appendages does not at once cure this condition. Therefore treatment, such as cureting, etc., may be subsequently required for relief.

I believe that any competent observer who will investigate the results obtained by Martin, Hegar, Péan, Tait, Price, and others, must be convinced that in the removal of disease involving the ovaries, tubes, and pelvic peritoneum lies the only cure for a large number of gynecologic patients whose sufferings we are otherwise almost powerless to relieve.

EXTRA-UTERINE PREGNANCY *

WILLIAM J. MAYO

Extra-uterine gestation is defined by Barnes as "a development of the impregnated ovum outside of the normal uterine cavity." Under this definition, however, cases of pregnancy in a uterus bicornis, so-called "missed labor," would be included, and as these are not strictly germaine to the subject, I will confine myself to true ectopic gestation, a condition named in ancient times and described in a general way. It was not, however, until the sixteenth century that there was anything like a proper conception of the few cases operated upon, and consisting, for the larger part, of the opening of abdominal abscesses containing fetal bones. A few scattering cases were recorded during the next three centuries, making but a scanty total of 62 operations up to 1876, when Parry wrote his work on "Extra-uterine Pregnancy." In 1849 Harbert suggested methodic operation for its relief, but little attention was paid to it, and this might also be said of the pioneer papers written by Stephen Rogers in 1866. As a matter of fact, the new era began only with the remarkable report of Lawson Tait, published in 1887, which exhibited so wonderful a knowledge of the subject that but little can be added to it today.

The known causes leading to this accident are predisposing rather than direct, women sterile for a long period and having a history of some derangement of the sexual apparatus, or those with congenital or acquired malformations of the uterus, being especially liable. The chief factor in causation is a pathologic condition of the tube. The original work of J. Bland-Sutton and Arthur Johnstone has shown conclusively that a desquamative

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*Read before the Minnesota Academy of Medicine, January 4, 1893. Reprinted from "Northwestern Lancet," April 1, 1893.

tube approaches the endometrium in character, and all competent observers are agreed that a previous salpingitis, gonorrheal or otherwise, is a history of a majority of cases. The small spermatozoa with power of motion may pass into a diseased tube, while the larger ovum, depending on the ciliated epithelium to waft it down into the uterus, lies stranded in a tubal lesion and impregnation and adhesion take place. Such impregnation occurring in a normal tube would have been denied lodgment and carried down into the uterus by the ciliated cells. Pozzi, in his late work, says that any disease of the tube which prevents the ampulla from applying itself to the Graafian follicle at the time of rupture acts as a cause. Price, in the history of his 83 unequaled operations and results, gives especial prominence to an emotional condition at the time of conception as an influential cause in the production of ectopic pregnancy, and most observers of large experience mention cases of this nature. Such an influence might be explained on the theory of perverted function of the tube.

To sum up, then, a change in the structure or function of the Fallopian tube can truthfully be said to cover the known etiology of extra-uterine gestation. Parry gave three varieties of this form of pregnancy: tubal, ovarian, and abdominal. Tait, with his accurate observation, reduced the number to a single primary variety, tubal, claiming that all others were due to adhesion or rupture. Greig Smith formulates the two following propositions in brief: (1) "All extra-uterine pregnancies are tubal in origin, and according to the location in the tube may be designated as tubo-uterine, Fallopian, or tubo-ovarian." (2) "Rupture before the fourth month usually takes place, with escape of the ovum either into the abdominal cavity or, more rarely, into the broad ligament." The growth of the ovum in the uterine portion of the tube has been called interstitial. Schultze believes that this form often ruptures into the uterus, and thereby accounts for many cases of obscure abortion. Tait, on the contrary, positively asserts that this never takes place, but that the rupture is always into the abdominal cavity, though it may be delayed in this variety until the fifth month. Kussmaul, after thorough research, declares that the majority of cases reported as interstitial pregnancies are in reality varieties of gestation in a rudimentary horn of a bifid uterus. Location and development of the ovum at or near the ampulla, especially if the fimbriæ are adherent to the ovary, may so grow into its stroma as to cause ovarian tissue to be found in the covering of the gestation sac, and no doubt many of these cases have been improperly classified as primarily ovarian. Reported cases of primary abdominal pregnancy, as well as ovarian, are far more frequent in past than in recent literature, and are, in most instances, of doubtful authenticity.

True abdominal gestation is rare; the digestive power of the healthy peritoneum is well known, and the possibility of its occurrence implies a previous disease of this membrane. Senn is now conducting experiments in regard to the possibility of its production in the lower animals. We shall await his conclusions with interest. That examples of ovarian and abdominal gestation have been found cannot be denied, but they are of importance more as pathologic curiosities than as a guide to the practical surgeon.

Rupture of the gestation sac nearly always takes place before the fourteenth week, although a few cases have been more or less accurately reported where the fetus has gone on to term in the tube. The rupture usually takes place at the placental site, and the ovum escapes either into the peritoneal cavity or into the broad ligament, forming two secondary varieties of ectopic pregnancy. The behavior after escape into the abdomen varies. Many of the patients die immediately from the hemorrhage, or repeated small hemorrhages may take place, with absorption of the fluid portion of the blood and encapsulation of the clot, forming an intraperitoneal hematocele. This in turn may be completely absorbed, or after a variable length of time may become infected and play the part of a pelvic abscess. Not infrequently the placenta may remain attached to the tube, and the fetus, as a rule, covered with false membrane, develop in the abdominal cavity to term, or even lie uncovered among the viscera, or the placenta may form secondary attachments to any viscus in its vicinity, probably by a species of migration; it has even been found in the uterus and the fetus in the abdominal cavity. After the death of the fetus it may become absorbed, or, encapsulated as a lithopedion, remain quiescent for years, at any time to undergo secondary changes forming an abdominal abscess, with the usual history. The question of rupture into the broad ligament has become more prominent of late, and a growing belief is manifest that the frequency of this secondary variety has been greatly exaggerated. It is evident to any student of the subject that the products of an intraperitoneal rupture well walled in by false membrane have often been erroneously supposed to be in the broad ligament. An examination of the tube will show that the broad ligament juncture is the strongest part of its structure, and in the ordinary meaning of the term there is no cavity in the broad ligament. It has frequently been asserted that blood will not coagulate in the abdominal cavity, and this is true so far as to the expectation that a bleeding vessel may check by clot formation, but intermittent hemorrhages, such as are not uncommon in the clinical phenomena of this terrible accident, may give a hematocele so well surrounded by adhesions that we have only to remember the days of "cellulitis" to recognize the liability of clinical error. That extraperitoneal hematocele may and does occur from this cause, or that the child may develop to term in the broad ligament, cannot be denied, and has been conclusively proved by the specimens of Hart and Carter, though it might seem difficult to distinguish between the changed peritoneum in these cases and a false membrane in the *frozen* specimen. My own personal experience has been limited to 4 cases. Two of them were intraperitoneal hematoceles, where no trace of the fetus could be found, but the history of the patients leaves little room for doubt as to their nature. I have the pleasure of presenting to you tonight the more advanced of the remaining specimens with fetus still attached to the placenta by the cord.

URETEROVAGINAL FISTULA, THE RESULT OF VAGINAL HYSTERECTOMY *

SUCCESSFUL REIMPLANTATION OF URETER INTO THE BLADDER

WILLIAM J. MAYO

Certain post-operative conditions occur with sufficient frequency to deserve special consideration, as in ventral hernia. In the newer fields of surgery untoward results, necessitated by pathologic conditions of like unpleasant character, occur, and among these none is more distressing than urethral fistula. Surgery of the ureter in the upper part of its course has been most ably worked out by Fenger, Van Hook, Kelly, and others, and the possibility of its complete obliteration, with atrophy of the corresponding kidney, has been proved by the experimental work of Robinson. Ureterovaginal fistula will occasionally occur as a result of vaginal hysterectomy, and more than 40 cases have been reported in the literature; half of these were, however, due to parturient injuries. The literature of this particular form of accident is very scanty, and those interested in the subject will find a review of a case reported by Picqua, and a paper by Bazy, in the "Annals of Surgery," November, 1893; also a review of a paper by Dunning in the "Annals of Gynecology," August, 1893.

Mrs. A. B., aged thirty-six years. On July 6, 1893, at St. John's Hospital, Winona, Minnesota, I removed, by vaginal hysterectomy, a large carcinomatous uterus. The operation was rendered very difficult by reason of old inflammatory adhesions to the right and posteriorly as high as the fundus of the uterus, Douglas' pouch being obliterated. The operation was done by ligatures, excepting the upper part of the right broad ligament, when the nature of the tissues rendered clamps necessary. In three weeks the patient was able to be around, but recovery was

*Reprinted from "Medical Record," February 10, 1894.

retarded by a constant flow of urine from the vagina. By injecting the bladder, this viscus was found competent, and by collecting the amount of urine flowing from the vagina it was found to be equal in amount to that expelled from the bladder, and normal in other respects. A probe introduced into the fistula at the apex of the vagina passed to the right, making it evident that the right ureter was severed in the infiltrated tissues at a point about one inch from its cystic termination. On September 10, 1893, the patient came to St. Mary's Hospital, and on September 12th, by means of a plastic operation, the end of the ureter was freed; a short channel lined with mucous membrane of the vagina was formed, connecting the ureter end with the bladder. Union was perfect so far as the channel was concerned, but failed at the bladder end, and the opening into the bladder promptly healed, leaving the fistula at a new point against its posterior wall. Three weeks later—October 3d—she was again etherized, and a flap of vaginal mucous membrane was raised just below and behind the fistula, forming a collar to its lower lip. A curved incision was now made into the bladder, just above and in front of the fistula. A long piece of ⅛-inch rubber tube was carried through the urethra, bladder, and out of the cystotomy opening; its upper end was cut obliquely, and several lateral openings were made along the upper three inches; this end of the tube was now passed up about an inch into the channel previously formed against the ureter end, and secured in this position by a catgut suture. The collar of mucous membrane behind and below the fistula was now turned forward and sutured by buried catgut to the mucous membrane of the bladder, and the posterior lower edge of the cut bladder-wall secured firmly to the denuded surface below and behind the fistula by silkworm-gut sutures. The rubber tube carried the urine from the end of the ureter through the bladder, and by its openings in the bladder drained that viscus and prevented tension, its external end passing through the urethra and into a bottle. The bladder was washed with boric acid solution through the tube daily, and boric acid given internally to keep the urine acid. By the softening of the catgut sutures which held its upper end in position the tube was easily removed on the eighth day, and was not incrusted. No leakage by the vagina took place at any time, and the silkworm-gut sutures were removed in sixteen days. There was but little vesical irritability after the first two weeks, and the patient was discharged in three weeks, with a vagina but little shortened from its normal length.

IS HYSTERECTOMY INDICATED WHEN THE OVARIES AND TUBES ARE TO BE REMOVED FOR INFLAMMATORY DISEASES, AND IF SO, BY WHICH ROUTE—THE ABDOMINAL OR VAGINAL?*

WILLIAM J. MAYO

In propounding this question to the society I hope to elicit a discussion of a vexatious problem which will benefit not only the specialist in gynecology, but also the general practitioner, who has so often been disappointed because of failure to secure a symptomatic cure in the patient he has sent to the surgeon for removal of the ovaries and tubes, even though the operation itself was followed by primary recovery.

Many elements enter into a consideration of this subject, and we must admit that a considerable percentage of the patients in whom the appendages have been removed for inflammatory disease have not been relieved of the symptoms which first forced them to apply to the physician. The effect of these unfortunate results upon the medical profession has been to discourage all operations for intrapelvic inflammation, and since many operations were needlessly performed for neurasthenic symptoms, rather than for structural change, the whole question has been involved in doubt, and frequently looked upon with suspicion by the conscientious physician.

Admitting that some cases have occurred in which the patient has exchanged neurasthenic ovaries for a ventral hernia, yet the vast majority of operations have been honestly performed, and if any mistake has been made, it has been in a lack of appreciation of the conservative operations inaugurated by Polk, Martin, and others, or a want of thoroughness in carrying out a consistent attack upon the whole of the pathologic process.

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*Reprinted from "Trans. Minn. State Med. Society," 1895, pp. 86–88.

Several years ago the New York school of gynecologists, under the leadership of Polk, rightly insisted that a disease which, in the vast majority of instances, began in the uterus and extended by continuity of tissue to the ovaries and tubes, must leave the activity of the uterus in such pathologic condition as to account for many of the unrelieved cases after the appendages had been ablated. They taught that proper curetment and drainage of an infective inflammation in the uterine cavity would many times save an abdominal section, and in all cases was a necessary step in the operative treatment of inflammatory disease. This treatment fully accords with the true pathology of the process, as pointed out long ago by Bernutz and Goupil, and which was forced upon the attention of the profession by the efforts of Lawson Tait. The soundness of this argument was testified to by the general and rapid acceptance with which it was received, and many patients were saved needless mutilation by this procedure. A certain percentage of the hitherto unrelieved patients were greatly benefited, and a few were definitely cured.

From this view of the nature of the failure to cure it was but a step further to recognize that a disease beginning and remaining in the uterus, although secondarily affecting the appendages, could not logically be expected to disappear after removal of these secondary effects in the shape of diseased ovaries and tubes, without removing the primary cause at the same time. The logic of this position is beyond question when we stop to consider that the uterus, when allowed to remain, is wholly useless functionally, and often a fruitful source of local degenerative processes or general neurasthenia. Little can be said in favor of leaving the uterus under such circumstances, save the additional danger of the operation itself, and even this would not be without compensation, as consent to a total removal of the uterus with its appendages would not be so readily obtained in the neurotic individual, whose postoperative vagaries have done so much to discredit the abdominal work of the gynecologic surgeon.

In reviewing my own experience in this line of work I am puzzled to account for one fact which I have observed: that the more extensive the actual disease in the appendages, the better the symptomatic cure without removal of the uterus, while the less pronounced the structural change, the greater the percentage of unrelieved patients. This may appear to be equivalent to saying that the unrelieved patients were essentially neurasthenic, and, therefore, not suitable for operative treatment. This, however, is not the fact; on examination I find it to depend more on the chronic nature of the pathologic process or the great length of time the disease has existed before the operation was performed. In either case the long-continued irritation would be a fruitful cause of nervous exhaustion, and render thorough removal of the whole of the inflammatory area of vital importance in the production of a permanent cure.

However this may be, I am convinced that removal of the uterus with the appendages for inflammatory disease is followed by a more speedy and altogether smoother convalescence, with less of that after-disturbance of the nervous system which so frequently follows salpingo-oöphorectomy, and while many cases which have heretofore been subjected to mutilating operations could be better relieved by conservative work on the ovaries and tubes, with careful attention to the uterus and the general health of the individual, yet for the more severe cases, in which the operation of removal of both ovaries and tubes is necessary, hysterectomy should also be done if the condition of the patient warrants the additional risk.

In this country the abdominal route is preferred by the modern school of surgeons. With moderate pelvic elevation and free exposure, removal of the ovaries and tubes with the uterus can be readily effected. The majority of these surgeons prefer to amputate the uterus just above the vaginal attachment of the cervix, believing that it leaves a stronger pelvic floor, with less danger of infection through the vagina. The peritoneal flap being united over the stump and the suture line well covered by filling the pelvic basin with the sigmoid, and protecting the whole by drawing the omentum well down without provision for drainage, except in very recent infections, in which time for self-sterilization has not elapsed. In these cases thorough drainage from above can be practised.

Dudley, Pryor, Krug, and others prefer to make a total hysterectomy and drain thoroughly through the vagina; as a rule, this adds something to the difficulties of the work, but their results are unexcelled. The objections urged against the abdominal method are:

1. The difficulty of the removal of the small uterus, especially when adherent, through the abdominal incision, but with free exposure and the Trendelenburg position the difficulties are not great, and every step of the operation is under the guidance of the eye.

2. The danger of infection through the cervix when left, or the vagina when it is removed. In an examination of the material removed from the cervical canal at the point cut across in nearly 40 cases, Welch was unable to find active pyogenic germs. The query arises, if the uterine cavity is not septic, why remove the uterus? But this is merely begging the question; the latent infection within the uterus and the pathologic condition left after the inflammatory storm give an abundance of logical reasons when we stop to consider that under such circumstances the organ is obsolete.

3. The danger of hernia as an argument in favor of the vaginal route. The masterly work of Halsted in demonstrating the value of the permanent buried silver-wire mattress suture renders the hernia question of small moment.

4. The mortality. The statistics of Kelly, Baldy, Penrose, Pryor, and Polk do not show a greater mortality than after simple ovariotomy or vaginal hysterectomy—3 to 5 per cent. on an average.

The vaginal operation is approved by the French, backed by such men as Péan, Richelot, Segond, and Jacobs of Belgium. The masterly showing made by these men, both as to permanency of cure and as to safety, must give this operation a high place, and their technic, so well demonstrated by Garceau in this country, is worthy of the highest praise.

The objections urged against the vaginal operation for inflammatory diseases are:

1. That it is a blind procedure, and while the uterus can always be removed, as much cannot be said as to the suppurative and adherent appendages. We are told that if the uterus is removed and the pus-pockets drained, no harm will result from the parts of the ovaries and tubes unavoidably left behind, and this assertion is backed with numerous cases, but it does not appear more logical to leave parts of the appendages than to leave the uterus, as we formerly did in such cases.

2. The danger of injury to the ureters in removing the adherent uterus. That this is not an infrequent accident is shown by many reported cases, one of which happened in my own experience in the removal of a cancerous uterus; 1½ inches of the right ureter was involved and was removed. While I succeeded, by a secondary plastic operation, in reimplanting it into the bladder, the annoyance for a time was considerable.

Segond claims not to have injured a ureter in over 400 vaginal hysterectomies for inflammatory diseases, and he believes it to be due to his incision, made by joining the anterior and posterior circumcervical incisions through the mucous membrane at each angle by a straight incision, ⅔ inch in length. This he claims on separation gives ⅔ inch more room between the ureter and uterus than the oval incision ordinarily practised.

3. The mortality and difficulties of the operation. Jacobs gives the mortality in over 400 cases as less than 3 per cent.; certainly this leaves little to be desired. That the operation is a difficult one for inflammatory disease I have personally experienced; many of these cases require hemostasis by the forceps, and morcellation must of necessity often be done. Yet I have been surprised at the easy and rapid convalescence which has followed after a hard and trying operation.

My own experience by both methods is too small to draw many conclusions, but certain indications for each operative route have impressed themselves upon my mind: (*a*) That where the diagnosis is uncertain or where it is thought that a conservative operation on the ovaries and tubes, after the methods of Polk and Martin, may possibly be done, the abdominal route is by all means the best. (*b*) That where the infection is acute and there are evidences that pockets of pus exist outside of the ovaries and tubes, the vaginal operation offers certain advantages in lessening the danger of operative infection, with a certainty of free drainage. In old cases of peri-uterine inflammation with abdominal, rectal, or vaginal fistulas, the vaginal operation is a life-saving measure, as by removing the uterus, which is the keystone of the small pelvis, the free drainage, as shown by Boldt, will cure many otherwise hopeless cases, and the fistulas, as a rule, heal with great rapidity. For the average case each operator will choose the method he is most familiar with. Personally, I prefer the abdominal route.

THE DIAGNOSIS OF SURGICAL DISEASES OF THE KIDNEY *

WILLIAM J. MAYO

A complete analysis of the diagnoses of surgical lesions of the kidney will not be attempted in this discussion, but rather to outline some of my own difficulties in diagnoses and my disappointment in them later at the operating-table.

Newman says that the division between medical and surgical lesions in many cases is at best an arbitrary one, and depends much upon the individual opinion of the attending physician. But thanks to the efforts of Newman, Thornton, Morris, Lange, and others, the question is becoming less complicated, and the indications for surgical treatment more clear.

The practical diagnosis of kidney disease depends, to a greater or less degree, upon one or more of the following means of examination: (1) The history; (2) the urine; (3) the presence of an enlargement; (4) exploratory operations.

The History.—I need hardly call your attention to the great value of a careful and complete history of the case. Pain in its relation to calculus and other pathologic lesions, the condition of the urine, the enlargement, if one exists, traumatism, and the chances of an infection through a previously diseased condition of the lower urinary tract, also the possibility of a communicated tuberculosis—all this suggests itself to you and needs no further comment from me.

The Urine.—The valuable evidence to be obtained from a careful chemical, biologic, and microscopic examination of the urine cannot be overestimated, particularly in suppurative disease and in the early stages of those diseases which later develop an enlargement. Pyuria from the kidney must be distinguished from pus from the lower urinary tract. It is frequently of ropy mucus. Examination of the bladder with the cystoscope will aid in eliminating this organ from the diagnosis. In many cases the suppuration is not confined to the kidney and its pelvis, but involves the whole urinary tract.

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* Reprinted from the "Northwestern Lancet," 1895, vol. xv, pp. 127–130.

The epithelial findings in the urine are not of much diagnostic importance. Casts are of value when found, as indicating degenerative changes in the kidney, while a large quantity of albumin without sediment is indicative of a hematogenous nephritis rather than a surgical lesion. Pus in the urine will account for a trace of albumin, but not for a quantity, and when found and not due to stone, tumor, or ulcer, is a sign of pyelitis or nephritis.

In a recent paper on "Nephritis in its Surgical Aspects" Keyes calls attention to the grave significance of polyuria as indicating an advanced degree of kidney degeneration or sclerosis. Hematuria in its relation to calculus, traumatisms, tuberculosis, tumors, etc., is also a valuable sign. The microörganisms of suppurative disease are now well understood and are of great diagnostic value. In this paper, and in one read by Sternberg before the American Congress of Physicians, these bacteria receive especial attention as regards their causative relation to the surgical forms of nephritis. The pyogenic cocci are most frequently found in connection with mechanical irritants, such as calculus, and in chronic suppurative disease, but the most important microörganism is the Bacillus coli communis, particularly as the cause of the most severe types of septic invasion. This bacillus has been recently identified as the one long described as the Urobacillus septicus, as well as many other terms. Unmixed with other germs, it does not cause alkaline change, and it explains the acidity of the urine in many cases of pyelitis and pyelonephritis, or so-called "surgical kidney." To Weir belongs the credit of calling attention to the frequency of this heretofore fatal lesion in one kidney, and demonstrated the possibility of removing the "surgical kidney" with success.

The Bacillus proteus is also a frequent cause of kidney suppuration, especially with alkaline urine, and a few cases supposed to be caused by the gonococci have been reported. The bacillus of tuberculosis is readily identified, and the examination of urine with a view to its demonstration should be a routine practice.

The microscopic examination of the urinary sediment for crystals, casts, epithelium, portions of tumor growth, hooklets of echinococcus, etc., requires no comment. For the purpose of careful examination of the urinary sediment a sedimentator is almost a necessity, not only as a saving of time over the precipitation method, but it also enables us to make the examination before decomposition renders the specimens worthless.

Renal Enlargement.—So important is a tumor in the diagnosis that cases might well be divided into those which present this sign and those in which it is absent or not sufficiently marked to be of value. The subject of movable kidney has so recently been discussed before this Society in the excellent paper by William Davis that I shall make no further reference to it.

The three special diagnostic features of renal growths are: (1) A tumor in the loin, enlarging in a direction forward and downward; (2) the location of the colon on the anterior and inner aspects of the growth; (3) that it is a more or less fixed tumor, and, as a rule, does not move with respiration or palpation. In growths involving a previously movable kidney this sign would obviously be of less value, and occasionally a movable hydronephrosis or carcinomatous kidney has been reported. Bearing these cardinal principles in mind, the differential diagnosis of ovarian and pelvic tumors becomes less difficult, the intestines lying to the outer side and behind.

By dilating the colon and stomach with air, tumors of the pancreas can be shown lying between the transverse colon and the stomach. Hydatids of intraperitoneal organs, encysted tuberculous ascites, mesenteric cysts, fecal accumulations, etc., can be eliminated by inflating the colon and by the exclusion method.

Perinephritic abscess is frequently the result of a kidney lesion, and the two processes often coexist; if it is independent of a diseased condition of the kidney, it can be easily differentiated. A splenic enlargement lies anterior to the colon and has a respiratory movement; there is also a resonant space between it and the spine, and the notches can usually be felt. Examination of the blood may show the characteristic changes marking certain forms of splenic disease. Tumors of the liver and gall-bladder have a respiratory movement, and the inflated colon lies along its lower border or underneath. Twice I have been unable to make a positive diagnosis in cases of supposed renal tumor. One of these was a woman with a right-sided growth, having a respiratory movement, and the inflated colon lying partly over and along the inner side. The previous history showed that a movable tumor about the size of a movable kidney had been present. Exploratory incision revealed carcinoma of the gall-bladder and Riedel's tongue of the liver, the inflated colon having wedged itself into the notch between the tumor and liver. Large tumors of the kidney in which the intestines are greatly displaced may be difficult of diagnosis and require exploratory incision; fortunately, these growths are not often contaminated, and the placing of the incision is of less consequence. I am convinced that inflation of the colon and the stomach is not so frequently practised as their great importance in diagnosis demands. Much of this neglect is due to the supposed difficulty in carrying out the tests. After a trial of several complicating procedures I have adopted the following simple methods: With a short rectal tube and an ordinary valve enema syringe air can be readily pumped into the colon, and by removing the syringe, it easily escapes through the tube.

For inflating the stomach a soft stomach-tube is introduced, and the same syringe closely pressed into the upper extremity of the tube; after the stomach is inflated by removing the syringe the air passes out.

I will not go into the differential diagnosis of double cystic degeneration in its relation to chronic nephritis, simple, congenital, and parasitic cysts of the kidney, calculus disease, pyonephrosis, hydronephrosis, benign and malignant growths, injuries, etc., but from an operative standpoint would suggest the great necessity of knowledge as to the probability of the kidney lesion having a septic complication; in other words, it makes little difference with a clean kidney whether the peritoneum is opened or not, while in septic lesions it materially augments the danger. This is well shown in a late paper by Israel.

Exploratory Operations.—The question as to the condition of both kidneys is always important, for even if the main difficulty be located in one, disease in the remaining organ may dictate the choice of treatment. In women the method improved by Howard Kelly of direct catheterization of the ureter is of practical utility, and has replaced the procedure of Polk. The instruments of Silberman and of Tuchman, as well as Newman's electric-light apparatus, are too complicated to be of much practical value in the male, and are less reliable in the female than Kelly's method. In the male, pressure upon the ureter of one side has been tried, as well as direct catheterization of the ureters, and in some instances has proved successful, but unless done through an open bladder, cannot be relied upon. When so serious an operation as nephrectomy is contemplated, it seems to me wiser directly to explore the remaining kidney by an incision. Fenger suggests for this purpose a lumbar opening. I prefer an anterior incision, as the kidney is firmly held against the palpating finger posteriorly. Exploratory puncture, or aspiration of a renal swelling for the purpose of diagnosis, I do not believe has the advantage of an incision. For therapeutic purposes it has its place, particularly in the iodoformization of encapsulated fluid.

Exploratory Incisions.—There will remain a small number of cases in which the diagnosis of kidney disease cannot be made, and a larger number in which there is less difficulty in locating the disease in the kidney than in defining its pathologic nature. In a general way it can be said that in a large and uninfected tumor the abdominal route, by Langenbeck's incision, has much to commend it, while in suppurative disease the lumbar incision of Simon is to be preferred, and, if need be, it can be carried forward along the iliac crest, as advised by Kocher, giving a comfortable working space. Trendelenburg prefers a trap-door incision, made by adding two transverse cuts to the Simon method. All in all, for large tumors of doubtful nature the transverse incision practised by Abbe is to be preferred, as permitting thorough retroperitoneal exploration, and by carrying the colon forward, with or without opening the peritoneal cavity, gives unlimited room.

Exploratory puncture through the kidney substance with a hollow needle for the purpose of ascertaining the nature of fluids in the renal pelvis, or with a round needle for stone, can be readily practised. For stone, however, the direct incision through the kidney into the pelvis and the introduction of the finger, as recommended by Morris, is to be preferred. The use of the cautery knife for making the exploratory kidney incision in my experience has little to commend it, as the clots along the seared surface are pushed off by the exploring finger. The hemorrhage can be easily checked by gauze pressure or the antiseptic tamponade. Should the bleeding be severe, catgut sutures can be safely trusted to control it. My operative experience with surgery of the kidney has been limited to 13 cases: 3 nephrectomies, 2 nephrolithotomies, 5 nephrorrhaphies, and 3 nephrotomies, with one death as a result of nephrotomy for pyonephrosis. The diagnosis of the renal disease was made in each instance, but the exact nature of the pathologic lesion in 2 cases was cleared up only by incision.

CESAREAN SECTION AND PUERPERAL HYSTERECTOMY FOR PREGNANCY COMPLICATING MYOFIBROMA; PORRO'S METHOD: RECOVERY OF MOTHER AND CHILD*

WILLIAM J. MAYO

Mrs. W. LeB., American, aged forty, was admitted to St. Mary's Hospital August 20, 1895, with the following history: The mother of 9 children, the last one born two years ago, after an unusually difficult labor. One year previous to this she first noticed a small tumor in the abdomen, which did not increase in size until after childbirth. From this time it grew rapidly, until, in the autumn of 1894, it was as large as the pregnant uterus at the sixth month; this rapid growth was accompanied by prolongation of the menstruation and much general disability. Her last menstruation occurred in December, 1894, and with the advent of pregnancy her sufferings were greatly aggravated.

In April, 1895, the diagnosis of pregnancy complicating a large uterine myofibroma was made. The advisability of interrupting pregnancy was not considered favorable at this time, and she was advised to wait until near the time of her expected confinement and then enter the hospital for delivery.

During this interval she increased in size to an alarming degree, and was confined to the bed almost constantly, requiring morphin at times to relieve her suffering. On admission to the hospital she was subjected to a physical examination which yielded the following results: A slender woman with a normal weight of 100 pounds; upper portion of body and face emaciated; lower limbs edematous; heart's action 116 and feeble; lungs normal, although the breathing is difficult on account of abdominal distention; micturition frequent; urine contains 0.1 per cent. of albumin, no casts; abdomen enormously enlarged; the body of the uterus with contained fetus can be felt high up in front to the left; the fetus lies with back anteriorly, vertex downward; fetal heart-beat, 140; the tumor lies behind and to the right, and appears fully to equal the pregnant uterus; the vagina is filled with a tumor the size of the fetal head, evidently in the posterior wall of the cervix; upon examination per rectum this appears to be an hour-glass portion of the abdominal growth, rather than a separate tumor; os uteri lies high up in front behind the pubic arch. Examination of the bladder shows it to be carried up nearly to the level of the umbilicus and to the left.

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*Reprinted from "Amer. Jour. Obstet.," 1896, vol. xxxiii, No. 1.

September 6, 1895: Labor began at 4 P. M. After the usual preparation the patient was removed to the operating-room at 5.30 P. M. Chloroform was administered, and an incision made in the cervical tissues covering the vaginal tumor, with a view to enucleating this mass, with possible extraction of the child through the vagina, or at least of removing an annoying complication to the operation from above. But after removing a portion of the growth the size of a cocoanut it was found that the result was merely to draw down more of the tumor. The uterine cavity was not opened. The free venous bleeding was checked with a gauze pack, and the abdomen opened by a high incision; an attempt to pass a rubber constrictor over the great mass to its base was quickly abandoned as impracticable. The uterus was incised without much hemorrhage close to the right edge of the placenta, and the membranes were ruptured, allowing the liquor amnii to escape. The child was extracted by the breech, which part was most easily reached. The after-coming head was somewhat tightly gripped by the contracting uterus; the uterine opening was therefore enlarged to permit easy delivery. The cord was doubly clamped and cut, and a living seven-pound boy was handed to an assistant. The placenta was left in the uterus. The abdominal incision was enlarged upward, and each broad ligament doubly clamped and cut below the ovary and tube before the mass could be turned out of the abdomen. The bladder was dissected off in the usual manner and the wire knot adjusted so as to include the broad ligament stumps; by partly removing the gauze pack from the space from which the tumor had been attacked on its vaginal aspect the relaxed capsule with the cervix from below was brought well up into the constrictor. The pins were inserted, and the tumor with the uterus cut away. The stump was fixed in the lower angle of the wound, and the abdomen closed in the usual manner. The operation of an hour was well borne, and the patient was put to bed in good condition. The after-history was unimportant. The pedicle, which the vaginal enucleation of the lower part of the tumor rendered of small size, separated in ten days, and the mother made an uneventful recovery. The baby was so fortunate as to obtain the services of a wet-nurse and progressed satisfactorily. The growth was a single soft myofibroma, developing originally from the posterior wall of the uterus, and was very edematous.

Several points present themselves for consideration:

1. Should the pregnancy have been interrupted or hysterectomy performed at an early period, saving the months of suffering and its attendant dangers? Little can be deduced from a single case; and while not presuming to say that every pregnant myofibromatous uterus should be allowed to go to term, the number of cases in which both mother and child have been saved, either by an unlooked-for natural delivery or by operative procedure, would certainly demand strong reasons for the sacrifice of the child, either by early hysterectomy or by the production of premature labor. In this case the fetus could not have been removed through the vagina at any time, and nothing short of hysterectomy would suffice; and unless the continued life of the child means almost certain death to both mother and child, I believe the child should have a nearly equal chance.

2. Could the operation have been done more safely from above without the partial removal of the growth by the vagina? I do not believe that the portion of the tumor presenting at the vulva could have been readily enucleated from above so as to allow the wire to reach its proper position, and to apply it at the hour-glass constriction at the level of the sacral promontory would have been to strangulate the whole vaginal mass. The so-called intraperitoneal operation, which has superseded the unsurgical constrictor in the removal of the fibroid or inflammatory uterus, would have been impracticable by the Baer method on account of the nature of the softened tissues, while a panhysterectomy, such as we would apply to malignant tumors of the uterine body, would have been a most difficult operation under the circumstances.

It was not the death-rate which drove us from the extraperitoneal treatment of the stump to the so-called intraperitoneal, but because we found the latter equally as safe and far more satisfying to every surgical instinct. A combination of circumstances will occasionally arise, however, in which the constrictor will possess positive advantages. Cesarean section after the Sänger method, which has proved so valuable for cases with contracted pelves, could not be considered in this case, as without removal of the tumor there would have lacked the vaginal drainage which is vital to this operation, and the removal of the tumor was a surgical necessity without regard to the pregnancy.

That Porro's operation will always have a larger mortality than simple Cesarean section is self-evident: the necessity which compels a complete removal of the uterus presupposes a seriously diseased condition of the uterus itself complicating the pregnancy.

SOME OF THE VARIOUS CAUSES OF PUS IN THE PELVIS *

WILLIAM J. MAYO

From the time Lawson Tait called attention to the correct pathology of pelvic suppuration, following the observations of Bernutz and Goupil, to the present period, the advance in gynecology was from a clinical and operative rather than from a pathologic standpoint. With Price, Kelly, Martin, and a host of others to lead the way, the fallacy of pelvic cellulitis, as previously understood, was quickly demonstrated, and gynecology became the center of attention in medical circles. The rapidly growing popularity of this specialty led a great number of men to engage in the work, and operation succeeded operation. First the diseased ovary and tube came out, then both were removed for fear the one remaining might become diseased. The uterus met the same fate. Art advanced beyond science, and new technic rather than scientific investigation became the order of the day. The result was a growing suspicion in the minds of the medical public that gynecologists had run mad, and wholesale denunciations of the gynecologist and his methods were not slow to appear. Clinical experience and statistics of recoveries will no longer avail. Pathology—that is, scientific investigation—is needed. In the different causes of pelvic suppuration lies the solution of the disputed problem.

The Effects of Gonorrhea.—The discovery of the gonococcus by Neisser has enabled careful investigation of the claims of Noegerrath, which had been supported by Tait, Sinclair, and to a great extent by the majority of modern gynecologists. This work finally led to good results. The universal acceptance of the view that intrapelvic suppuration traveled by continuity of structure from the vagina to the uterus, and thence to the Fallopian tubes, in the vast majority of instances, made the idea appear natural that a pus-tube originating in a gonorrhea must be due to the gonococcus. However, when a large number of competent observers, such as Roswell Park, Williams, and others, demonstrated that the gonococcus was not a pus-producer, in the ordinary sense of the term, much confusion was the result, and great differences of opinion existed among leading bacteriologists.

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*Reprinted from "Northwestern Lancet," 1896, vol. xvi, pp. 343, 344.

This seeming disproof of the assertions of the operating gynecologist was looked upon with suspicion by the general practitioner, who had heretofore been silenced, if not convinced.

Upon close study we find that the gonococcus has the power to penetrate the intact mucous epithelium, and by so doing furnishes the ordinary pus-microbes the solution of continuity, without which they are powerless. Secondary suppuration takes place, and a pus-tube results. According to Kelly, even in the peritoneal cavity the gonococcus does not cause greater mischief than pronounced adhesive inflammation similar to bile or iodoform gauze. If the Fallopian tube be filled with the products of a pure gonorrheal inflammation, no drainage need be secured after the removal of the tube, for fear of a gonorrheal suppurative peritonitis. We must, therefore, view gonorrhea as a condition needing the most careful aseptic management to prevent suppurative infection, with its attendant dangers, and it also explains why an active gonorrhea may complicate an otherwise normal labor without causing a puerperal fever in the mother, although the baby's eyes may not escape damage.

Latent Gonorrhea.—This is a condition which, at present, cannot be satisfactorily explained. Observers have noted that, under suitable stimuli, an apparently cured gonorrhea will break out, and after months of absence the gonococcus will reappear. It is this great resistance and its tendency to hide deeply in the tissues that render gonorrhea so obstinate. It has been found in the muscular tissue of the uterus itself, and herein lies the explanation of the clinical views expressed by so many operators, that if pus exists in one tube, both should be removed, as the other will later almost surely become affected. This is undoubtedly true in the majority of cases of pus-tubes having their origin in gonorrhea. The pus-microbes may die out, but the gonococci continue to live and furnish grounds for future assault by fresh pus-producers, with resulting reinfection of the remaining ovary and tube. By remaining in the uterus they continue, at intervals, to cause trouble, resisting the curet and iodoform gauze so ardently recommended by Polk, until, in desperation, the removal of the uterus with the diseased ovaries and tubes follows. This mutilation extended to a class of cases in which the origin of gonorrhea had no part, and has done much to add to the gynecologist's contention.

It must not be forgotten, however, that the great majority of cases of gonorrheal inflammation recover and remain well. The gonococcus may, under rare conditions, produce pus, but this unusual action need not be considered in this discussion.

In the April, 1896, number of the "Johns Hopkins Bulletin" Thayer and Blumer thoroughly discuss the question of gonorrheal septicemia. From late observations they have come to the conclusion that the gonococcus is an ordinary pus-producer. Observations by Williams, who has also made a special study of the bacteriology, show that he has been unable to find gonorrheal pus which did not contain ordinary pyogenic microörganisms. This result has also been arrived at independently by Roswell Park. Even should the gonococcus be the sole cause of some cases of pus in the pelvis, I am convinced that its most important rôle is in allowing the entrance of ordinary pyogenic organisms and giving them a field in which to work.

Pelvic Suppuration Following Labor, Abortion, or Injury.—The work of various observers has shown that the vagina may contain a large variety of pathologic bacteria and the uterine cavity be sterile. The germicide action of the vaginal secretions has been definitely proved by Döderlein, and that cultures of pus-microbes introduced into the vagina disappear in a short time. König has shown that at the time of labor the pathogenic microbes are either absent or so attenuated as to be harmless in the majority of cases.

Not less important is the condition of the uterus in regard to the possibility of lodgment of pus-microbes. Very early abortion would encounter more active pus-producers in the vagina, but would furnish much smaller surface for infection. After the formation of the placenta a greater danger of infection is unavoidable, and particularly if the placenta be retained, as it is liable to be attacked by the ever-ready vaginal saprophytes of putrefaction, and later by the pus-microbes still present in the vagina. This view of the causation is borne out by the frequency of pelvic suppuration and local peritonitis in abortions at this time. At term the danger from the vaginal microbes, as before stated, is small, but the wound surface open to accidental invasion of pus-producers is very large, and the possibilities of systemic poisoning are correspondingly great, general peritonitis being therefore rather more frequent as a result of infection at this time than local suppuration. If we bear in mind a few facts in regard to the common pus-producers, the clinical phenomena are explained, and a pathologic basis may be established.

The great peptonizing power of the staphylococcus tends to the early formation of large single accumulations of pus, while the short life-history of the germ quickly limits the process, and simple incision and drainage may cure the case.

Reuben Peterson quotes Schauta as saying that 50 per cent. of the cases of pelvic suppuration following labor or abortion are caused by the common pyogenic germs. Here is a scientific explanation of what we have all seen, particularly in rural districts—the self-cure of pelvic suppuration through spontaneous opening into the rectum or vagina, with future undisturbed pregnancies. This class of infections has also furnished the field of triumph for the advocates of vaginal drainage.

Cheyne believes the tendency of the streptococcus to travel along the lymphatics and through the blood-current due to its long chains becoming mechanically entangled with the corpuscles. This method of invasion and its great power of resistance account for some of the more obstinate cases and also for many of the cases of general peritonitis. The amount of pus in pure streptococcus infection is relatively small as compared with the large amount of coagulation necrosis, on account of the inefficiency of its toxin as a liquefier of inflammatory products. The colon bacillus is more often a saprophyte than an obligate parasite, and as a pus-producer usually secondary to some more active but shorter-lived bacteria. It can be shown by accurate observation that multiple abscess and stricture are less common with ordinary pus-germs, and the necessity for complete operation correspondingly less than in the gonorrheal variety. Perhaps an exception should be made in certain forms of streptococcus or secondary colon infection.

Herein lies the difference between the experience of the gynecologist doing work in large cities, where gonorrhea is common, and the country practitioner, with whom the ordinary form of pelvic suppuration is most often met. Two points must always be borne in mind: First, that several forms of pus-microbes are usually found; second, that the microscopic determination of its botanical class gives no idea of the power of infection of a given microbe.

The question as to the advisability of the removal of the uterus in any and every case where the ovaries and tubes are removed will not be discussed further than to say that my experience coincides with that of Peterson, who believes that painful symptoms are most frequent in the ovaries, and that the uterus is more commonly the cause of the nervous phenomena. Pelvic cellulitis with suppuration may occur, and cases of this character have been reported by Noble, Penrose, and other competent observers. They are usually post-puerperal in origin. Rare cases of pelvic suppuration due to the extension by way of the uterine lymphatics were long ago pointed out by August Martin and Winkle, though for a long time denied by Tait, Baldy, and those who believed that the exclusive path is by way of the uterus and tubes. Besides the very large class of cases in which the travel of infection is by way of the vagina, uterus, and tubes, and the very rare cases in which the lymphatics are the route, there still remains an important class in which the blood is the medium of conveyance of the infection.

The work of Williams, Cullen, and others seems to have established tuberculosis of the ovaries and tubes, and this form of pelvic suppuration is, in the large majority of instances, conveyed in this manner. The cases of pneumococcus abscess of the ovaries reported by Etheridge undoubtedly belong to this class, although, from the clinical standpoint, there are many reasons for believing that direct infection is not infrequent by the ordinary route.

The rapidity of the diffusion of the peritoneal form of tuberculosis of the ovaries and tubes, even where collections of purulent débris, known as "cold abscess," exist, usually prevents the radical operation which the nature of the case would indicate. Secondary tuberculous abscess as a result of disease of the vertebral, sacro-iliac, or hip-joints may also occur.

The Appendix as a Cause of Pelvic Suppuration.—The close relation which often exists between the right ovary and tube and the appendix has led to considerable confusion. We have operated upon a number of such abscesses, and have supposed we were dealing with a pus-tube until the operation was well advanced. The large variety of bacteria which are turned loose by rupture of the appendix accounts for many peculiar phenomena. The presence of the gas-forming bacillus causes the not infrequent presence of gas, while mixtures of pus-germs with saprophytes give rise to a lactic-acid fermentation and thin pus, which is not uncommon.

Perivesicular inflammation with intrapelvic abscess originating in infections from the bladder have been fully dealt with by Hotchkiss in an article published in the "Annals of Surgery," February, 1896.

THE TREATMENT OF POSTERIOR DISPLACEMENT OF THE UTERUS *

WILLIAM J. MAYO

Backward displacement of the uterus is an exceedingly common condition, and every practitioner, whether engaged in gynecologic work or not, has an occasional case to treat or to advise as to treatment. The general practitioner is the one who is consulted first, as a rule, and on his good judgment the future condition of the patient will largely depend. I think it well for us, therefore, occasionally to discuss these topics of mutual interest from different standpoints, for the purpose of arriving at some definite conclusions as to the proper course to pursue. It would seem to me that the genital organs of woman had suffered from an excess of operative zeal, to her detriment and our discredit.

There are undoubtedly a large number of women whose uteri are displaced backward in whom there are neither local nor general symptoms which demand relief. I am willing to admit that posterior displacement is not a normal condition, yet if the uterus is not enlarged or inflamed, causes no pain and does not interfere with the comfort of the patient, it is a question whether or not any treatment is indicated.

In a general way backward displacements of the uterus can be divided into four groups: (1) Retroversion; (2) retroflexion; (3) either of the foregoing conditions associated with prolapse; (4) retrocession—an important group in which the uterus is carried backward as a whole by a shortening of the uterosacral ligaments, a condition described by Jarman. Clinically, the most important distinction is the movability of the uterus. In retroversions which are adherent with associated diseases of the ovaries and tubes and

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*Reprinted from "Trans. Minn. State Med. Society," 1897, pp. 40–43.

pelvic peritoneum, the displacement may be considered only a small part of the pathologic condition and a sequel of the former disease. In such cases treatment directed to the ovarian and tubal diseases will be more rational than efforts at overcoming the retroversion.

Gill Wylie has contended for years that it was not the malposition, but the accompanying inflammation, which caused the symptoms; this, however, begs the question, as the retroposition is a cause of the chronic congestion which permits the infections and their results. Mundé remarks that movable posterior displacements in single women often cause no trouble, and it is no doubt true that these displacements are less important in virgins than in married women, for obvious reasons. If married, sterility may result from this condition without other symptoms. Women with retroversions who have passed the menopause rarely require treatment, as the uterus is too small seriously to interfere with the functions of other organs, no matter what its position. If senile endometritis exists, however, the displacement will require attention.

Local Treatment.—In subinvolutions with retroversion local applications and glycerin tampons applied in Sims' position are valuable means of treatment, and if begun sufficiently early, the displacement may be cured by relieving the congestion and supporting the overstretched ligaments. My own experience has been that subinvolution, with resulting displacement, is very common after abortion, and also more common in women who fail to nurse their children. We have all noted the lactation involution of the nursing mother, in which the uterus is even smaller than normal and less liable to become displaced.

In acute retroversions, such as are seen after traumatisms, or in those due to the muscular relaxation of prolonged illness, such treatment is usually sufficient to effect a cure. In the pregnant retroverted uterus this method is of the utmost value, and may save an otherwise inevitable abortion.

Mechanical Aids.—A great deal of time has been spent in the attempt to support a displaced uterus by mechanical means. The extent and variety of instruments constructed for this purpose are simply appalling, and nothing could more completely demonstrate their futility. The rise and fall of the pessary is one of the curiosities of gynecologic history. A survey of this extensive field would seem to warrant certain conclusions:

First, that all pessaries with an external support should be relegated to the curiosity-shop. Second, that intra-uterine stem pessaries are more potent for evil than for good. Third, that soft-rubber pessaries are filthy and act as a hot bed for the culture of bacteria, and their value for more than temporary use is dubious.

The Hodge lever pessary, or some of its modifications, as the Albert Smith or Thomas, has stood the test of time, and in certain selected cases of movable retroversions is a valuable adjunct to other treatment. Schultze, of Jena, who has done a great deal of work in this field, thinks that a large percentage will be cured by relieving the inflammation and fitting a pessary. Emmett, Thomas, and many of the older writers concur in this opinion. My own belief is that only a small percentage of permanent cures can be expected by this means of treatment. As a temporary support, it has great value.

After plastic work on the vagina or cervix or shortening of the round ligaments, a well-fitting pessary, to be worn for several months, is a wise precaution. Hot douches of plain water should be used frequently while the pessary is in position. If salty substances are dissolved in the douche, it may cause a precipitate on the pessary and irritate the vaginal walls. A pessary may be used with comfort and relief to the patient for many years in some cases of chronic retroversion, rendering its wearer good service. Under such circumstances it should be carefully watched and removed occasionally for cleansing purposes. All in all, the pessary can be said to be a necessary evil, occasionally useful, more often useless or harmful. Before leaving this subject, I wish to second Mundé in his commendation of the Gehrung pessary as a support to the anterior vaginal wall in the cystocele of aged women, in whom operative relief may not be considered advisable.

Plastic Work on the Cervix and Vagina.—The vagina has its fixed point below, with a movable uterus at its upper attachment. Laceration of the pelvic floor permits downward sagging of the vaginal walls, and the uterus must accompany the descent. In this way a normal uterus may be prolapsed and retroverted. Repair of the pelvic floor by a proper perineorrhaphy, with the introduction of a pessary until the overstretched ligaments regain their tone, is curative. Lacerations of the cervix of great hypertrophy may keep up constant uterine congestion or inflammation; here trachelorrhaphy, or amputation of the diseased portion of the cervix, is indicated, and, as a rule, the complete removal of the diseased tissue by free amputation is better than classic cervix repair.

The mere presence of a cervix tear in an otherwise normal uterus does not justify any cervix operation whatever. Cureting is often indicated in these cases, and not only removes diseased endometrium, but, if purulent discharge be present from the uterus, the cleansing is of great value in preventing wound infection of the repaired tissues of the cervix and vagina.

Ochsner has had excellent success in curing chronic retroversion by amputation of the cervix, hypercorrecting the position of the uterus, and then repairing extensively the pelvic floor. The reposition of the uterus by means of a uterine sound or repositor is not good practice. The large majority can be replaced by the bimanual method, or, better, by the procedure of Kelly, in which, with tenaculum forceps caught in the anterior lip of the cervix, the uterus is drawn down and straightened; with the finger in the rectum the fundus is elevated, the cervix is then pushed backward, and the bimanual method resorted to for the complete reposition.

Alexander's Operation.—Shortening of the round ligaments, introduced by Alexander, and associated with his name, has had a peculiar history. In the early period it was applied to all forms of retroposition, with many resulting failures. It was then largely abandoned for more radical measures, such as ventrofixation. The latter operation often caused great difficulty in patients who became pregnant, and with further experience it was shown that in easily movable uteri the Alexander operation had stood the test of time. Stocker, Mundé, and others reported a large percentage of permanent cures. Difficulty in finding the ligament caused modifications of the original operation. Dudley and Goffe shortened from the inside of the abdomen. Kocher split up the canal, and Frank opened the peritoneum on each side freely. Edebohls applied it to adherent retroversions, first opening the abdomen and liberating the adhesions. With the advent of anterior colpotomy, Vineberg and Byford began to shorten the round ligaments through the vagina.

With few exceptions every gynecologist has his own methods. I have shortened the round ligaments in more than 75 cases, both from within the abdomen and without, and in my own opinion the original method of Alexander is the best operation and gives the desired result with the least manipulation. It must always be borne in mind that the prerequisite to its performance is a freely movable uterus, and that all sources of drag from below must be relieved by plastic operations. These can be done at the same sitting.

Intra-abdominal Operations for Retroposition.—The ventrosuspension of Kelly is a close competitor of the Alexander operation in any case, and if the uterus is adherent or there is accompanying disease of the ovaries and tubes, it is the best operation with which I am acquainted. Noble reports a large number of ventrosuspensions which became pregnant, and no difficulty resulted that could be attributed to the operation. I have performed this operation more than 50 times, and have had four patients afterward conceive, with natural labors; two of these patients were married and had been sterile for several years.

If there be prolapse of the ovaries and tubes, even with a movable uterus, I prefer Kelly's ventrosuspension to Alexander's operation. I have frequently loosened adherent ovaries and tubes, and by ventrosuspending the uterus, been able to dispense with castration, with excellent results, the tender ovaries and tubes being drawn up out of harm's way. One patient became pregnant afterward. I prefer the exact operation of Kelly, attaching to the peritoneum only with two buried silk sutures. In no case wherein pregnancy is possible should ventrofixation be performed, as abundant evidence of its harmful effects are recorded, such as abortion, impossible labor, Cesarean section, and the like. Complete prolapse in aged women may necessitate a very firm ventrofixation in addition to plastic work. Ventrofixation consists in firmly attaching the uterus to the muscular walls; ventrosuspension, to the peritoneum only. The result in the latter operation is a slight band of connection which is sufficient to keep the fundus anteverted. The intestines lying against the posterior walls of the uterus hold it in proper place.

Temporary sutures for ventrosuspension may cause unreliable adhesions and lead to future relapse. Many of us have had the experience of opening an abdomen, to find everything matted together by adhesions, as in an appendiceal abscess, yet reopening the same abdomen at the end of several months find that all the adhesions had melted away. If silk has been buried at the first operation, it will be found thoroughly encapsulated and the adhesions about it persisting. It is the same with ventrosuspension, the buried silk acting to prevent the absorption of the adhesive band.

Vaginofixation, like ventrofixation, has been abandoned in all cases in which pregnancy is possible; the same harmful effects are seen, with additional danger of after-difficulty with the bladder. Introduced by Sänger, Mackinrodt, and Dührssen, and modified by Doyen, uterovaginal fixation still remains a bad operation. It might be useful in a case in which vaginal section had been done for other purposes and future pregnancy was out of the question.

I will not mention further the many modifications of the abdominal or vaginal operation; they are too frequently a tribute to the industry, rather than the discrimination, of the inventor. An exception to this might be the use of the urachus, by Fowler, with which to suspend the uterus, and the posterior colpotomy of Pryor. After vaginal section for drainage Pryor's method may be valuable in a small number of cases.

After the ovaries and tubes have been removed, there can be little benefit in fixing the uterus in the wound. Price, with his great experience, says that after the ablation of both appendages the broad ligaments are hauled taut and retain the uterus permanently in normal position.

The retrocession of Jarman may require division of the uterosacral ligaments through the vagina for relief.

THE TREATMENT OF EXTRA-UTERINE PREGNANCY *

WILLIAM J. MAYO

The treatment of extra-uterine pregnancy should be surgical, and it is the consensus of opinion among surgeons that the operation should be performed in the majority of cases as soon as the diagnosis is made.

Looking backward over the history of the management of ectopic gestation, three distinct periods may be found:

1. The time in this century in which the whole subject was involved in mystery; a few cases wherein abscesses had formed and when incised were found to contain fetal remains comprised the sum-total of surgical experience. The case of Bains in 1540 belonged to this category.

However, the almost forgotten writings of Bernutz and Goupil bore some fruit. In 1849 Harbert, and in 1864 Rogers, both Americans, recommended operation.

2. In 1875 Parry, in his work on "Extra-uterine Pregnancy," reported 62 cases, with about 50 per cent. of successes.

The profession now began to wake up to the importance of the subject, and various measures of treatment were recommended, notably the use of morphin, in doses lethal to the fetus, introduced by Joulin, in 1863, and electricity, recommended by Voillemier about the same time, and which had extensive trial.

Other measures of equally doubtful utility were tried and likewise abandoned.

3. This second period of experimentation was brought to an abrupt close by the remarkable report of a remarkable man, Law-

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*Reprinted from "Trans. Minn. State Med. Soc.," June, 1898.

son Tait, published in 1887, and little can be added to his original paper to this day. The storm of opposition and abuse which Tait aroused during the next few years certainly drew the attention of the surgical world to the subject.

For the purpose of treatment, cases of extra-uterine pregnancy can be divided into two general groups: before the formation and attachment of the placenta in the fourth month and after this period. In the first group the operation can be performed without regard to the fetus and placenta. In the second group the importance of these two factors cannot be overestimated.

The diagnosis previous to rupture has seldom been made, although Herman, of London, and Hirst, of Philadelphia, have recorded some cases. If this should be done, early removal of the diseased tube, with or without the corresponding ovary, can be safely effected.

After rupture the operation will be to check the active hemorrhage, which permits of no delay, or the removal of an accumulation of blood-clot with the diseased tube to prevent further bleeding.

The extent and rapidity of the hemorrhage depend somewhat upon the location of the rupture in the tube; the nearer to the fimbriated extremity, the greater the chance of temporary clotting, and this applies particularly to tubal abortions.

Price says that cases of rupture at the uterine end of the tube go to the undertaker, rupture in the outer part of the tube to the surgeon, and that the middle portion is debatable ground.

The character of the operation depends upon the condition of the patient. If bleeding is active at the time the diagnosis is made, the operation is as imperative as the ligation of any other bleeding vessel, and it is surprising to note the recovery of patients, apparently almost moribund from shock and hemorrhage, after rapid removal of the diseased tube and blood-clots.

It sometimes happens that an immediate operation cannot be performed; under such circumstances the foot of the bed should be elevated into a high Trendelenburg position, to diminish pelvic blood-pressure and to maintain circulation in the vital organs.

In this position, as shown by Clark, absorption is active, especially by the diaphragmatic peritoneum, and the effused blood will be readily reabsorbed. It should not be forgotten that the depression of the circulation and faint condition of the patient lessen arterial tension and favor clotting; therefore, as Fothergill points out, stimulation beyond the absolute necessity for life is not indicated unless operation is performed at once and the bleeding vessels secured. In this manner I have twice tided patients through a collapse, and after the reaction have operated in the usual manner. The abdominal route will be practically always chosen for this operation if active hemorrhage is present or has been recent, as it permits of more accurate work.

Kelly has advocated removal and drainage through the vagina if there is well-marked encapsulation of the blood-clot. In one or two of his cases Kelly was compelled to open the abdomen and tie the bleeding vessels, which the manipulations from below had caused to start up, and which the gauze packing had failed to check.

There is one class of cases in which vaginal section is indicated rather than the abdominal operation. That is where the hematocele resulting from the rupture of the gestation sac has become infected. This may occur in patients in whom the fetus is dead and the vessels are occluded through natural processes, the infection supervening before absorption is complete. In three such cases I have found the vaginal operation simple, safe, and satisfactory. The collection will usually be in Douglas' pouch.

The method I have employed of opening these and similar pelvic accumulations through the vagina is as follows: Grasp the posterior lip of the cervix with bullet forceps and have an assistant steady the uterus gently. The middle finger of the left hand is covered with a well-oiled condom and inserted into the rectum, and the index-finger of the same hand in the vagina, the perineum being between the fingers. The uterus, steadied with the tenaculum, marks the anterior boundary, the finger in the rectum the posterior boundary, and the index-finger acts as a guide to the base.

With a pair of curved sharp scissors the pocket can be opened and drained with gauze, as advised by A. W. Abbott, or if the walls are very rigid, a rubber tube can be sutured to the vaginal wall, as practised by Archibald MacLaren.

In the abdominal operation, if the hemorrhage has been recent, on reaching the peritoneum it will look dark or black from the effused blood behind it.

After incision no time should be lost in tying off the broad ligament and removing the tube and its contents, beginning, if most convenient, from the uterine side; the ovary, if healthy, should not be removed.

The clots are rapidly scooped out with as much of the sac-wall as can be conveniently loosened, the toilet of the peritoneum being more or less complete as the condition of the patient permits. If there is no infection, too much time need not be spent in this regard, and the abdomen should be closed without irrigation or drainage.

If the blood-loss is great, saline solution may be left in the abdominal cavity, and in addition intravenous or subcutaneous cellular transfusion be performed. If the indications are not acute, rectal enemata of one or two pints of saline solution will answer the purpose.

Should there be a doubt as to the sterility of the blood accumulation, free drainage with gauze, through either the vagina or the abdomen, is indicated.

Excessive hemorrhage after ligation of the ovarian vessels on the affected side seldom occurs previous to the fourth month; hot sponge pressure will usually check the oozing; should this fail, gauze packing after the plan of Mikulicz is an admirable method.

The ovaries are not diseased in these cases, as a rule, and they should not be needlessly sacrificed. I have noted with regret a tendency on the part of some surgeons to remove both ovaries and tubes in operations for ectopic gestation, first on account of the adhesions which will soon disappear, and, second, to prevent that rare accident in which, at a later date, tubal pregnancy occurs on the remaining side. I have had one case in which this occurred, requiring removal thirteen months after the first operation. The frequency of tubal pregnancy and the rarity with which it afterward develops in the remaining tube are too well known to require discussion. I have had two patients upon whom I have operated for extra-uterine pregnancy who have afterward raised one or more children without difficulty.

A great many cases of extra-uterine pregnancy become self-cured, developing a pelvic hematocele which is gradually absorbed. This fortunate termination should not lead us to place reliance on expectant treatment, however, except in a small minority of cases seen when, the dangers having been successfully run, only a well-encapsulated blood-clot remains for nature to dispose of.

The treatment after the fourth month depends on whether the child is alive or dead. If alive, it is a question which must be settled upon its own merits; delay to term gives the child a chance, but increases the danger to the mother.

In a number of cases which have gone to term very few living children have been the result; of these few offspring the percentage of defectives has been enormous, and at the end of a year the number remaining alive is so small as to make a thoughtful man wonder if it is worth the increased mortality of the mothers.

My own feeling is that if the mother is in good condition and the indications are that the fetus is vigorous, the child should be considered and operation performed at or near term.

As to how the operation should be conducted is not settled. Tait says that the secret of success is to avoid the placenta, suturing the sac to the incision, and providing free drainage.

Martin and Olshausen advise removing the placenta and membranes if possible. In my limited experience I have operated twice upon extra-uterine gestations some time after the development of a placenta, both late in the fifth month, and while the fetus had been dead a short time in each case, the placental circulation was still complete. In both instances I removed the placenta and membranes at once, and in each the hemorrhage was terrific. One was checked by firm gauze packing, and in the second I was compelled to do hysterectomy to control the hemorrhage.

Werder has directed attention to the fact that the bleeding is from the uterine artery as well as the ovarian in these more advanced cases.

In another case operated upon during the fourth month ligation of the ovarian and uterine vessels on the affected side enabled me to remove the fetus, placenta, and membranes with a minimum amount of hemorrhage.

In operating between the fourth month and term the preliminary ligation of these vessels in favorable cases might enable the surgeon to make clean work, trusting to ordinary surgical measures to control the hemorrhage from the intestines, mesentery, or other parts involved.

After the fetus has been dead for some time the vessels of the placenta become occluded, and complete work can usually be done.

Herman believes that, occasionally, the placenta may grow after the death of the fetus. Bland-Sutton, a most careful observer, does not agree with this view. Certainly in some cases circulation is maintained for weeks after the death of the child. Each case must be managed on its individual merits, and the desire of the surgeon to do clean and thorough work must be modified by existing circumstances.

In one case, after opening the abdomen and viewing the situation, the thickness of the sac-wall and the signs of recent peritonitis led me to close the abdominal incision and open up through the vagina, removing in this way a putrescent mass of fetal remains and placenta.

Death of the child at or near term, with encapsulation of the entire product, has occasionally occurred, requiring operation months or even years later. In one case twelve years after the prolonged illness which gave rise to a tumor, I removed a considerable part of a fetal skeleton.

I have made no separate mention of the small class of cases in which the rupture occurs into the broad ligament, as it does not modify the treatment to any extent.

My own experience comprises 31 operations for extra-uterine pregnancy; all the patients recovered.

A REPORT OF TWO CASES IN WHICH A STONE IN THE URETER WAS REMOVED BY OPERATION *

WILLIAM J. MAYO

Surgery of the ureter is a new field comparatively, and in its development the efforts of American surgeons justly rank high. The experimental and practical work of Fenger, Van Hook, Cabot, Fowler, Matas, Kelly, and others has contributed largely to the establishment of systematic operative procedures for the relief of diseases and injuries of the ureter.

Removal of stone from the ureter was first suggested by Velpeau in 1851, as the result of a postmortem made upon a case under his observation, but it was not until 1879 that Emmet removed a stone impacted in the lower ureter by an incision through the vagina, and shortly after, in a second case under his care, a stone was removed through the bladder.

In 1882 Bardenheuer removed stones from the ureter by direct incision through a lumbar opening, suturing the divided ureter into the external wound.

In 1887 Godlee removed stones from the ureter by direct incision, followed by suture, and this operation has been repeated a number of times, both by extraperitoneal and transperitoneal methods. To those interested in this subject the work on renal surgery by Morris will prove profitable.

Case 1.—*Stone Impacted in the Upper Ureter—Removed by Lumbar Incision.*—H. J., female, aged forty years; admitted to the Rochester (Minnesota) State Hospital for the insane March, 1895, suffering from melancholia.

* Reprinted from "St. Paul Medical Journal," August, 1899, pp. 598–600.

On admission the patient was anemic; uterus retroverted; profuse vaginal discharge; urine contains some pus. During the succeeding summer it was noticed that she had frequent sick spells, complaining of severe pain in the right side; a quantity of pus would then be discharged with the urine, and relief for some days followed.

Examination December 10, 1895: A tender tumor in the region of the right kidney was palpated, evidently a pyonephrosis. On December 12, 1895, a lumbar nephrotomy was made, the pelvis being freely opened through an incision in the renal cortex, and a quantity of pus was evacuated, but no stone discovered. Drainage was instituted and continued for eleven months. For a time all the urine with pus escaped through the nephrotomy, and it was noticed that during this period the urine from the left kidney was normal and nearly double the quantity of that from the right.

On November 13, 1896, it was decided to explore the kidney and ureter, and, if necessary, to remove the right kidney, as the prolonged drainage had not yielded material improvement. A long lumbo-iliac incision was made, and after considerable difficulty the adherent kidney was brought up to the external wound; in doing this the peritoneal cavity was accidentally opened and temporarily packed with gauze. The ureter, which was held taut by the elevation of the kidney, was examined through the peritoneal cavity, and about 3 inches downward a stone could be plainly felt. After considerable effort the stone was dislodged and forced along backward nearly to the pelvis. The drainage opening through the renal substance was enlarged, and a finger introduced through the pelvis would nearly reach the stone. A longitudinal cut was now made from the tip of the finger to the stone, which was removed. The incisions were sutured with catgut and drainage established through the renal substance and the kidney returned to its normal position. The drainage continued six weeks, and the wound then healed. The patient's mental condition continues the same, but physically she is well. The stone was 1¼ inches long and shaped like a nail, the head being upward.

Case 2.—*Stone Impacted in the Lower Ureter—Removed by Transperitoneal Ureterotomy: Recovery.*—A. K., female, married, aged forty-one years; admitted to St. Mary's Hospital May 12, 1899.

History.—The mother of two children, the youngest thirteen years of age. Seven years ago she had a miscarriage, since which time she has suffered from some chronic uterine difficulty for which she has been treated without much benefit. Menses regular. September 1, 1898, she was suddenly seized with severe pain in the right loin, for relief of which morphin was necessary. This attack lasted about twelve hours, and was followed by some disturbance of the bladder and rectum. Three months later this attack was repeated, and at intervals since, until for the past two months the pain has been more or less continuous in the region of the appendix and right broad ligament. During the exacerbation of pain vomiting occurred frequently. The menses have been prolonged and painful, and there is quite marked urinary disturbance. She has lost 30 pounds in weight.

Present Condition.—A rather stout woman, 5 feet 5 inches in height, weight 143 pounds. Heart and lungs normal, uterus enlarged, somewhat fixed and tender, particularly on the right side. Urine on repeated examinations always showed a trace of albumin, and after the centrifuge a few pus- and blood-corpuscles; no casts. Examination of bladder negative. External examinations revealed the point of greatest tenderness to lie just below McBurney's point.

Operation May 16, 1899. A five-inch incision was made through the right rectus muscle down to the pubes. Appendix normal; both ovaries of the small cystic variety. Beginning at the base of the right broad ligament a soft enlargement the size of the thumb could be traced upward over the brim of the pelvis and to the right kidney. Just at the broad ligament it ceased abruptly, and a small hard nodule could be felt. The anterior peritoneal fold between the bladder and uterus was freely divided, the uterus drawn back, and the bladder separated to its base. Beneath the uterine artery the stone could be felt plainly, so close to the bladder that it was thought possible to remove it through that viscus. Accordingly the urethra was dilated, and the forefinger inserted into the bladder, but even with the aid of the hand in the abdomen the stone could not be identified. An attempt was made to force the stone backward into the dilated ureter, but it could not be done. With considerable difficulty the tip of the forefinger was inserted underneath, and two catgut sutures caught through the walls of the ureter on each side of the stone. The ureter was incised longitudinally, and a dumb-bell stone about the size of two large peas fused together side by side was removed and the sutures tied. The peritoneal fold of the bladder was pushed down over the divided ureter and a gauze drain inserted. A Jacobs' self-retaining catheter was introduced into the bladder. There was no leakage, and the drain was removed in five days. Patient discharged in excellent condition June 24, 1899.

HYPOSPADIAS *

CHARLES H. MAYO

Hypospadias of some degree is one of the most common malformations of man. According to Rennes, Kaufman, and others, this deformity occurs in 1 of every 350 males.

There are several theories as to the cause of this condition. Some claim that from atresia of the urethra there is fetal retention of urine, and finally a giving way of the urethra, or that the same result is caused by a delay in the development of the glandular urethra. The most probable cause is the one given by Reichel, who states that hypospadias is merely an arrest of development, and the degree of deformity is an indication of the period of intra-uterine life at which it occurred. Perineal openings develop in the sixth or seventh week, and glandular openings from the twelfth to the sixteenth week.

The more common variety is the glandular or balanic, in which the urethral opening is situated back of a broad, flattened, and curved glans, the frenum being absent. The penile type of hypospadias opens at some point between the scrotum and glandis corona. The scrotal variety is presented by those cases with the urethral opening at the juncture of the penis and scrotum, called penoscrotal, or in the extreme cases perineoscrotal, in which the scrotum is divided.

There is no malformation which may be the cause of more mental suffering and physical discomfort than the one under consideration, the trouble being none the less from its secret nature. A limited number have some degree of incontinence, and many are compelled to pass the urine in a sitting posture from the difficulty of directing the stream. In many cases the urethral opening is so

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* Reprinted from "Jour. Amer. Med. Assoc.," April 27, 1901.

small that there is difficulty in evacuating the bladder. The penis, from imperfect development of the corpus spongiosum, may be deformed, curving downward and at times adherent to the scrotum, perfect erections or coitus being impossible; and the majority of even the balanic type of cases are sexually impotent. It is a matter of interest in this connection that several aboriginal tribes of Africa and Australia make a fistula or slit in the urethra to prevent impregnation.

Operations.—There are several methods of operation for the relief of hypospadias, which Van Hook classifies according to the principles involved: (1) The method of simple canalization; (2) denudation and suture; (3) the use of penile flaps; (4) taking flaps from the abdomen or scrotum; (5) the combination of these fundamental methods. To these may be added a sixth—mobilization and dislocation of the urethra.

The operation of Dieffenbach, first made in 1838, consisted in piercing the glans penis from its summit to the normal urethra, and allowing a cannula to remain in position until the canal became lined with epithelium, the previous opening of the urethra being closed. This operation was abandoned from the difficulty of maintaining the lumen of the canal when formed. Dieffenbach was also a pioneer in the operation by denudation and suture. The flap operation of Duplay has until recently been the one most commonly employed. The first step was Bouisson's principle (Fig. 50), to straighten the penis by transverse incision at the point of greatest curvature, and, after straightening the organ, to close the lozenge-shaped defects by skin-grafts or sliding flaps (Fig. 51). The age of choice for this operation is four years.

The second step is the formation of the new urethra over a catheter, to a point in front of the hypospadiac opening. This is done by an incision on each side of the urethral groove, leaving a strip about ½ inch wide, which is dissected one-fourth its breadth toward the median line from each side and folded over the catheter (Fig. 52). Transverse incisions are made at the ends of the urethral incisions, and the outer flaps dissected freely and closed over the catheter and new urethra by quill suture and accurate coaptation

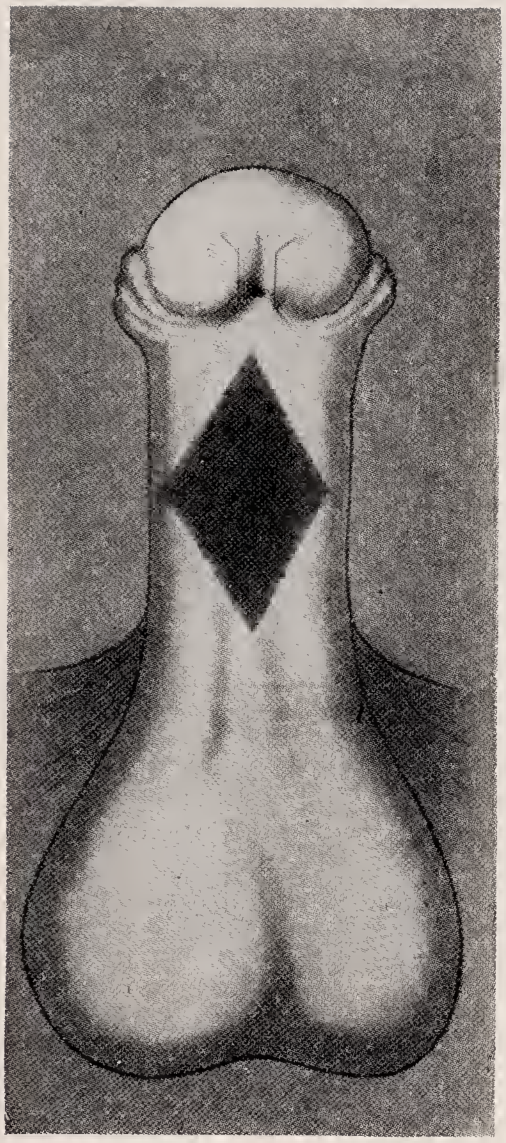

Fig. 50.—Duplay and Bouisson.

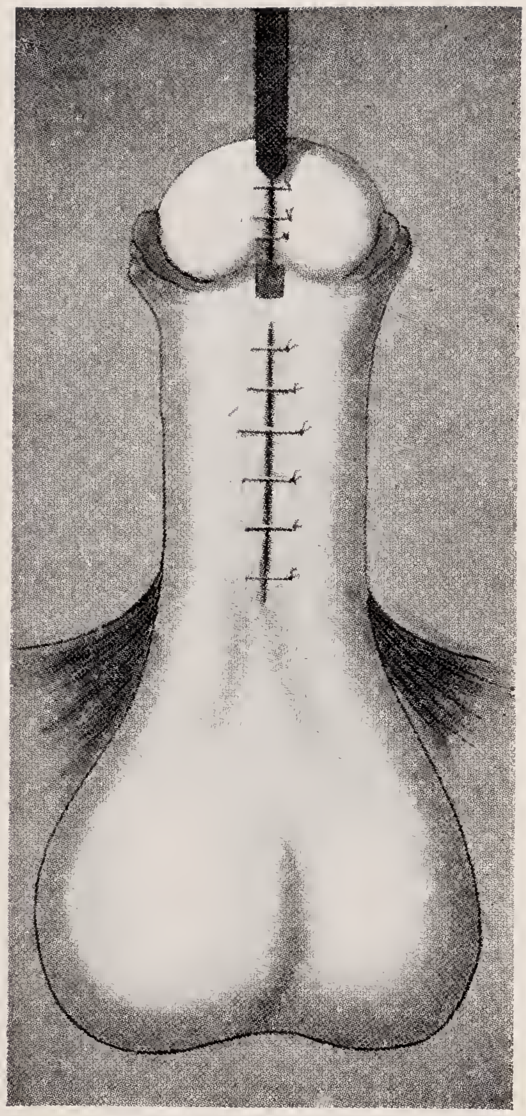

Fig. 51.—Duplay and Bouisson.

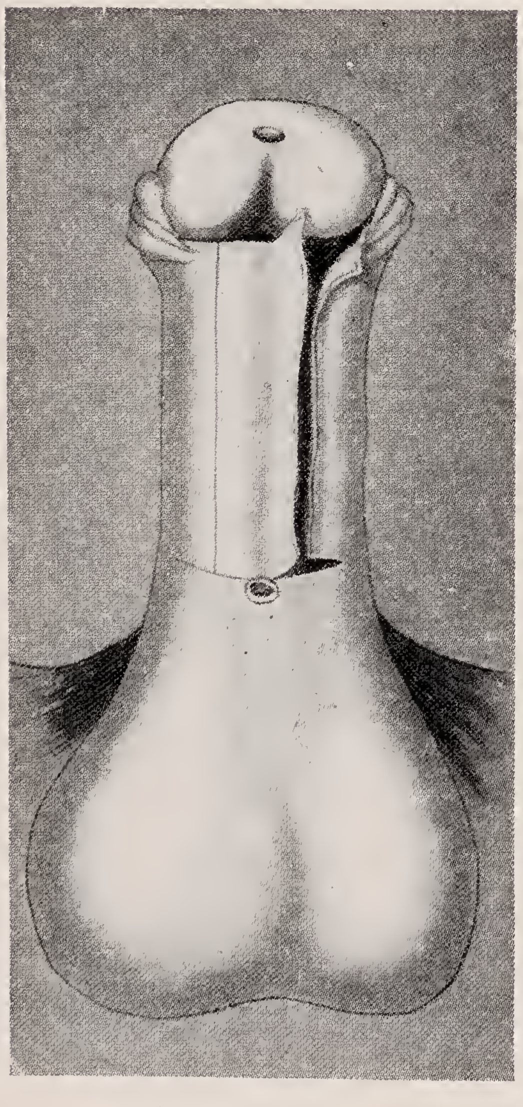

Fig. 52.—Duplay.

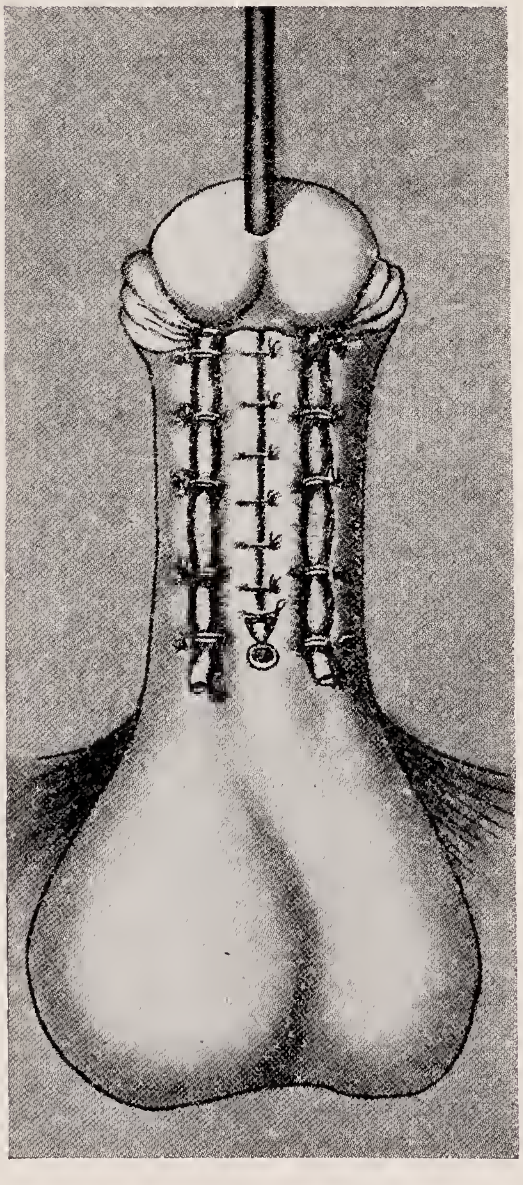

Fig. 53.—Duplay and Thiersch.

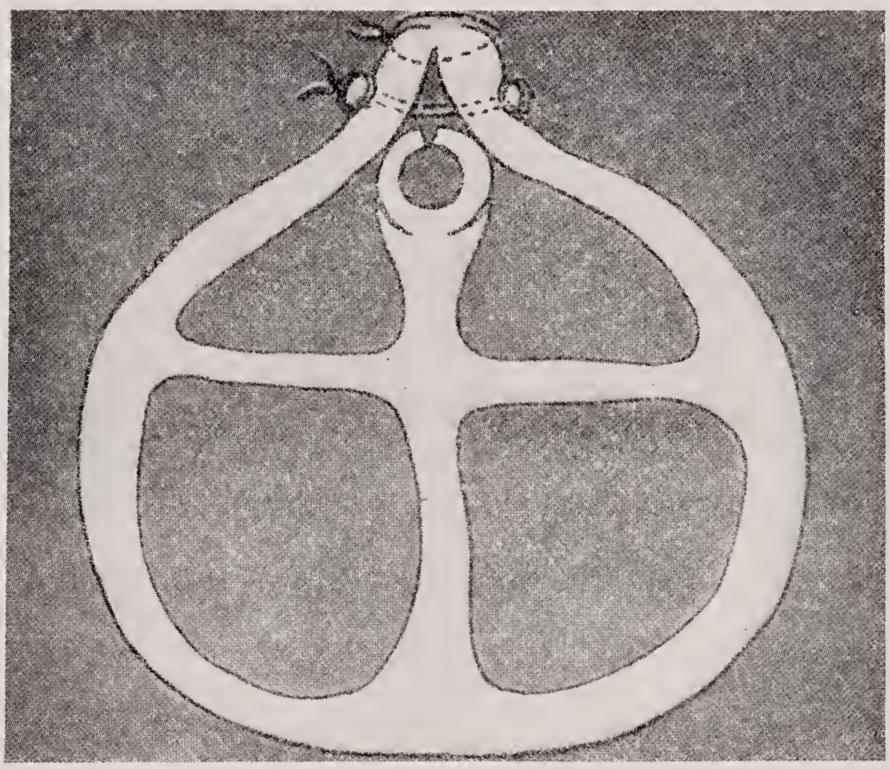

Fig. 54.—Duplay and Thiersch.

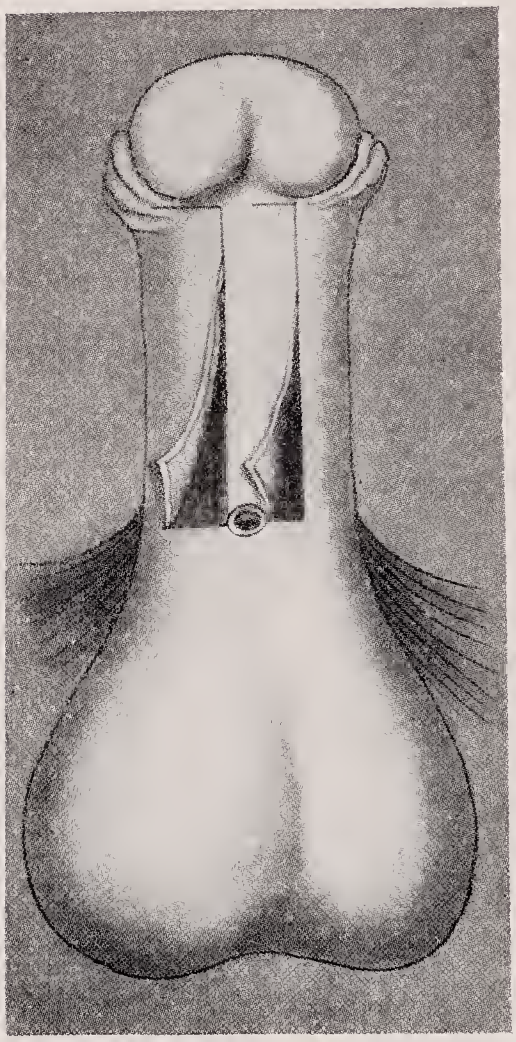

Fig. 55.—Thiersch.

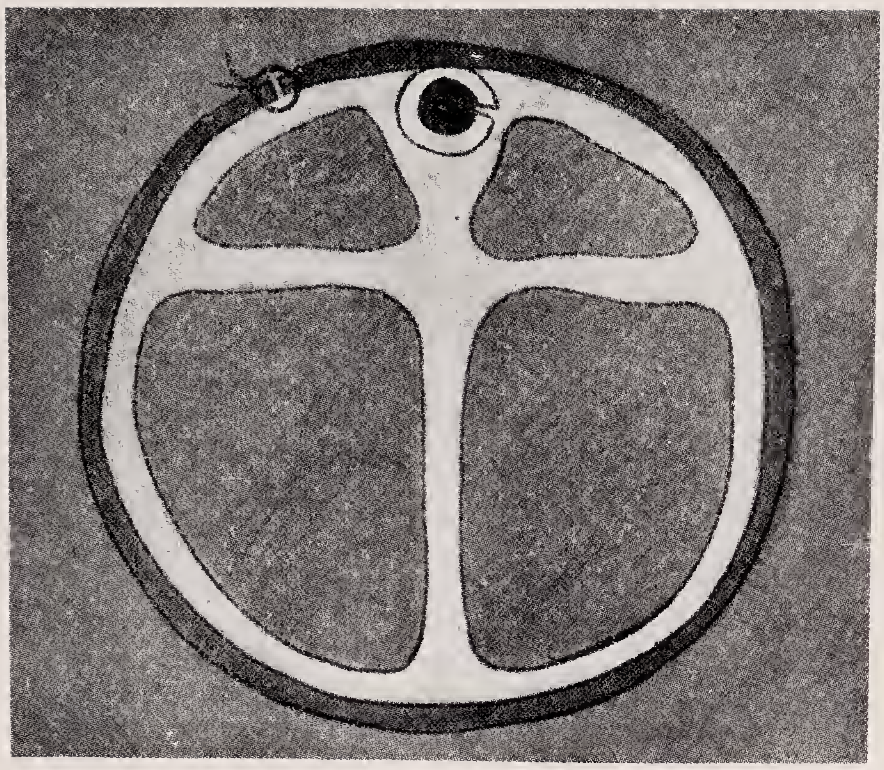

Fig. 56.—Thiersch.

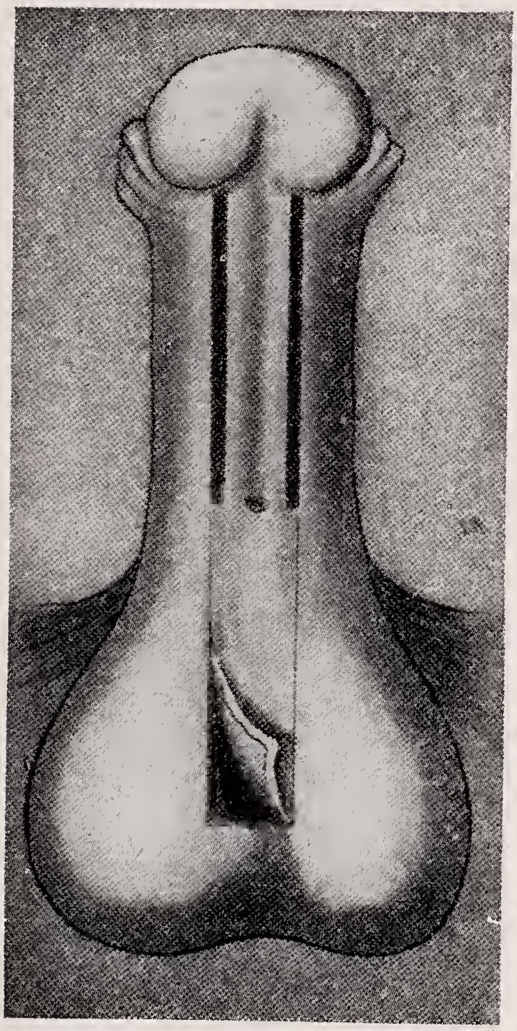

Fig. 57.—Wood.

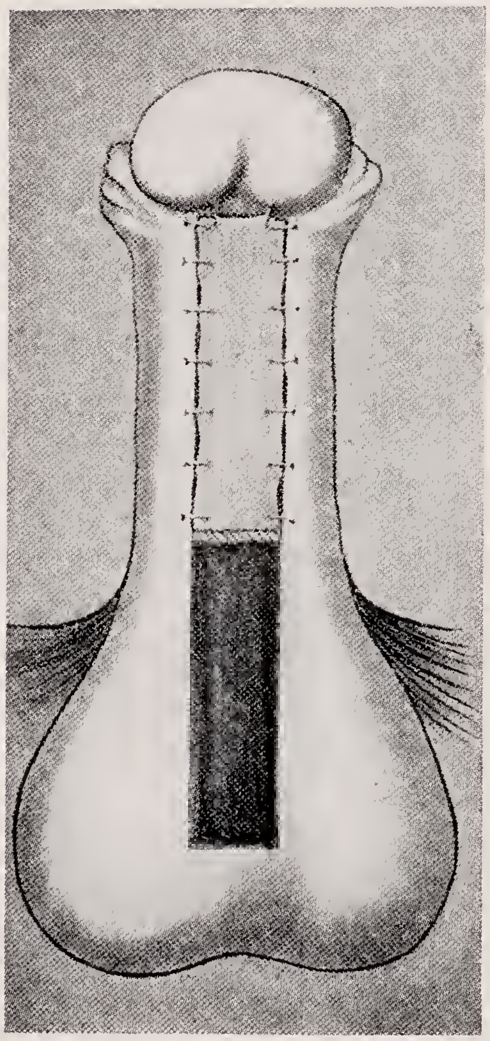

Fig. 58.—Wood.

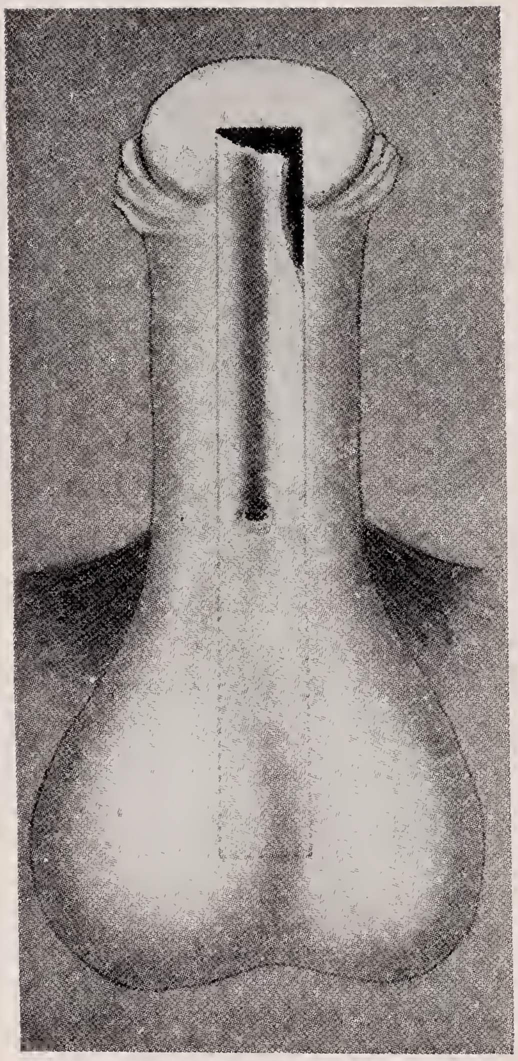

Fig. 59.—Duplay, Wood, and Beck.

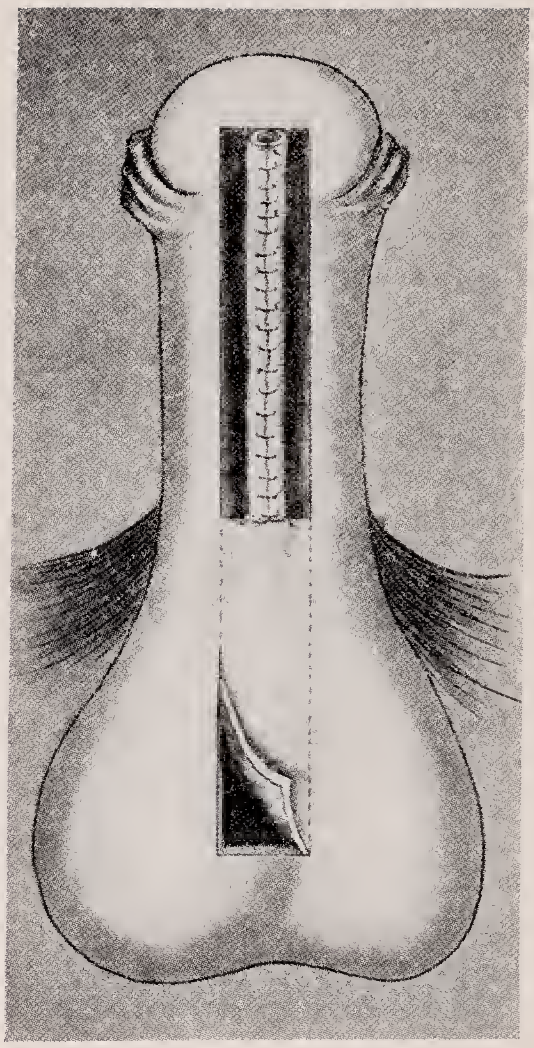

Fig. 60.—Duplay and Beck.

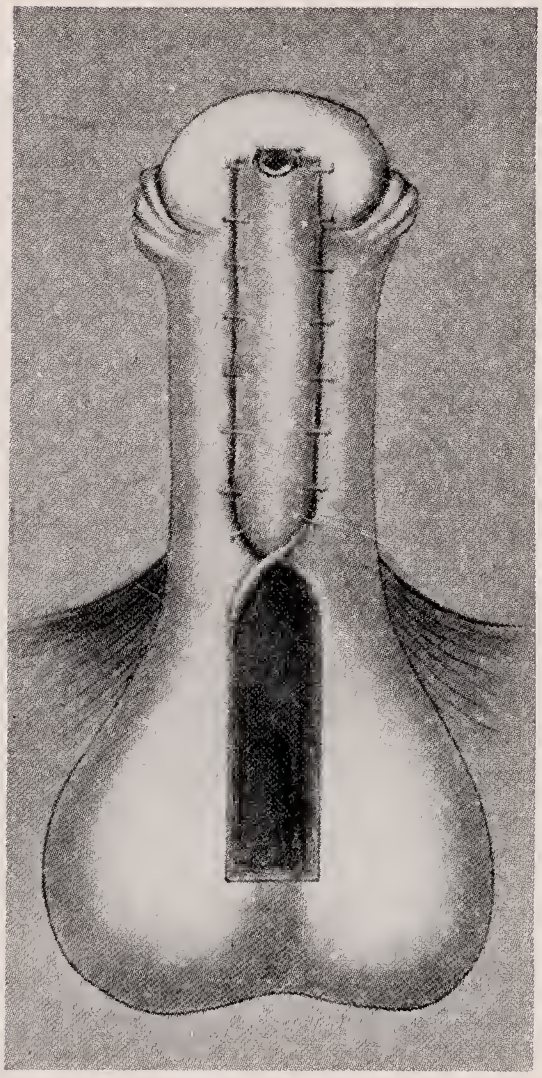

Fig. 61.—Beck.

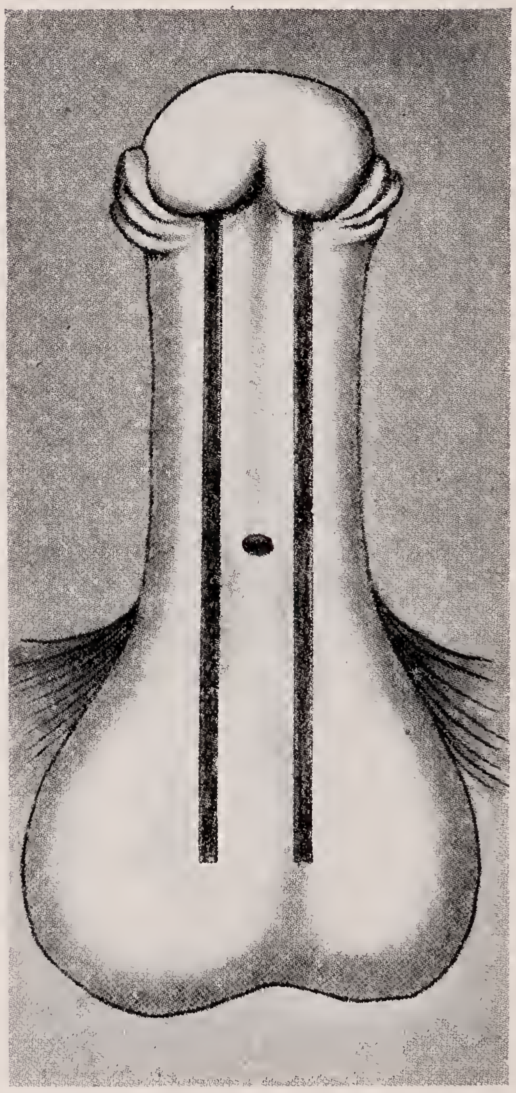

Fig. 62.—Rosenberger, Landerer, and Bidder.

of the skin margins (Fig. 53). The lateral flaps were devised by Thiersch, Duplay making use of a flap of prepuce to cover the defect and new urethra. The glandular urethra is often constructed at the first operation, the age of choice being five or six years (Fig. 54).

The third step is the union of the two urethras, done by freshening the openings and accurate suturing; this operation is best made at the age of puberty, to secure the aid of the patient in after-care. Thiersch devised the method of double penile skin-flaps, the base of one being near the urethral groove, the other on the opposite of the penis (Fig. 55). Flaps are dissected up and one turned skin side in, to form the urethra, the other drawn over the urethra and sutured to the opposite side of the penis (Fig. 56). Thiersch also deserves credit for temporarily deflecting the urine by a buttonhole in the perineal urethra, which he used in epispadias.

In the Wood method (Fig. 57) a large buttonhole is made in the center of the prepuce near its attachment, and the glans drawn through the opening, leaving the prepuce underneath the glans. A skin-flap with its base close to the urethral opening is turned up from the scrotum (Fig. 58). Two narrow strips are denuded from either side of the urethral groove, and the scrotal flap sutured to these. The scrotal defect is closed by sutures, and the flap is covered by the prepuce, which is unfolded for this purpose.

In his penoscrotal cases, Beck utilizes the Duplay method (Figs. 59 and 60) and covers the new urethra with a scrotal flap like the Wood operation, by twisting the pedicle to turn the skin surface out (Fig. 61).

Rosenberger's operation for epispadias is made by incisions and denuding strips each side of the urethra, which are continuous with and sutured to similar denuded surfaces upon the abdomen, and later the organ with attached skin is separated from the abdomen and the denuded skin grafted. This method was so commonly successful that the principle was utilized in hypospadias by Landerer and Bidder, who denuded strips on the under side of the penis (Fig. 62) and sutured to incisions in the scrotum (Fig. 63); then, when healing was firm, dissection of the penis with its new canal from the scrotum and skin grafting or turning the skin margins over the defects in surface covering. This operation leaves considerable deformity, but has fewer failures than many of the earlier ones.

Causes of Failures.—There are several causes of the frequent failures experienced by all operators in this class of surgery. The field of operation is difficult to render sterile. Flaps are made too small and closed under tension; dressings become soaked with urine. The bladder is drained by a catheter fixed in the canal, and, after the third day there is the straining of an irritable bladder, which frequently expels the catheter, or forces out urine alongside of the instrument. Frequent erections are also a cause of much discomfort. In a considerable number of hypospadiac cases operated on in Czerny's clinic about 35 per cent. of them were uncured from the patients' lack of persistence in having repeated operations, and 29 per cent. of the operations were failures from failures of previous operations, not counting cases healed with minute fistulas requiring cautery or caustic for their closure. In 1897 Carl Beck, and shortly afterward von Hacker, devised a new operation for the relief of the balanic type of hypospadias and for the penile cases with an opening near the glans. The distensibility and extensibility of the organ, with all its structures, furnished a basis for the operation. It is well known that the penis in a state of erection is nearly double its length when flaccid, the corpus spongiosum and urethral walls containing much elastic tissue. The Beck operation consists in completely mobilizing sufficient urethra to extend to the position in which it is wished to place the meatus (Fig. 64). The urethral site on the glans is freshened and made of sufficient depth to close the glans over the tube of the urethra (Fig. 65). The urethra is exposed by an incision well back along the penis, and is freed from its bed and its opening sutured to the glans. The incision is closed by sutures which also serve to build a frenum by attaching the freshened prepuce to the base of the glans penis (Fig. 66). When there is a shallow groove and little deformity, the glans may be tunneled with a narrow bistoury or trocar, and the tube of urethra drawn through

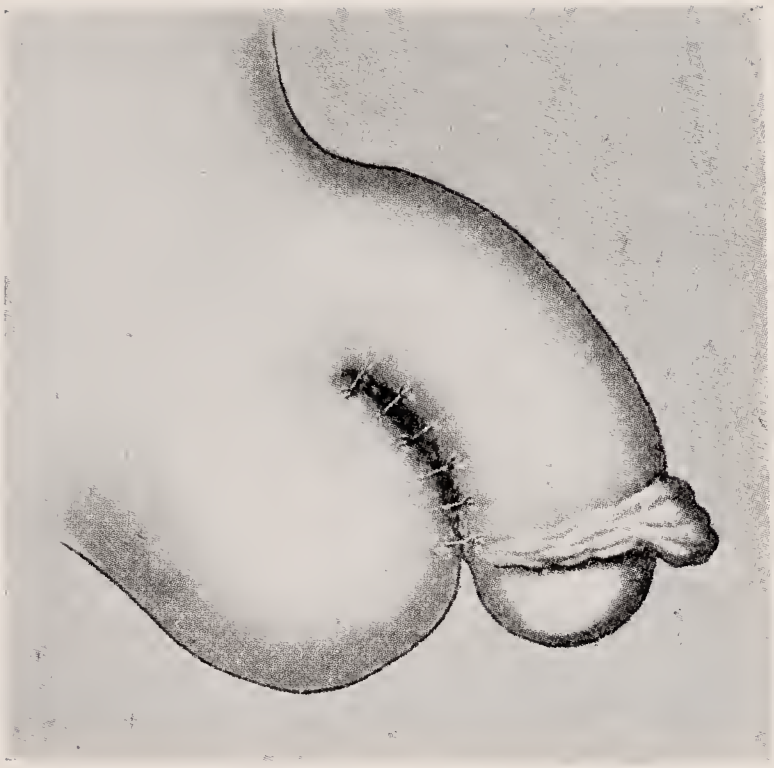

Fig. 63.—Rosenberger, Landerer, and Bidder.

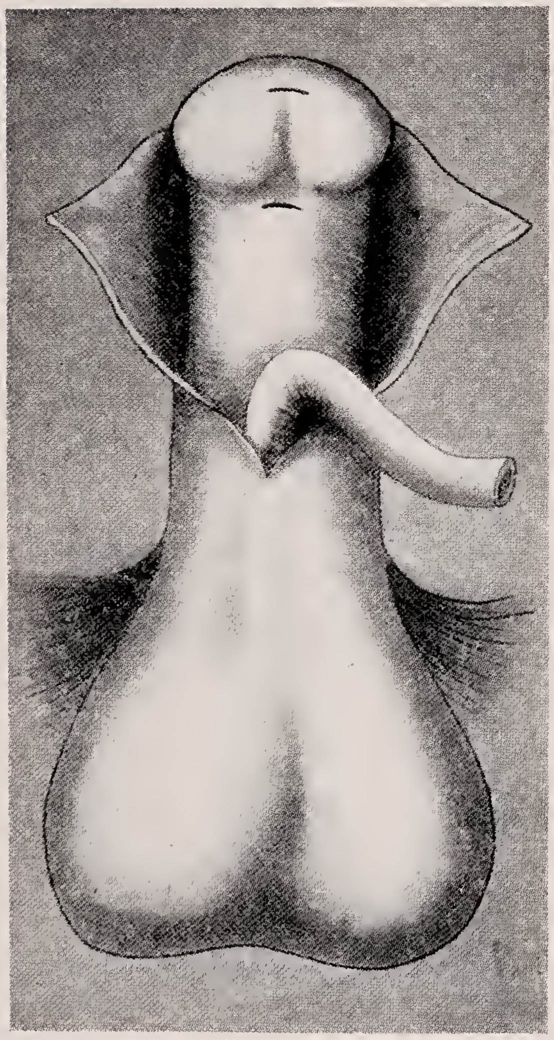

Fig. 64.—Beck.

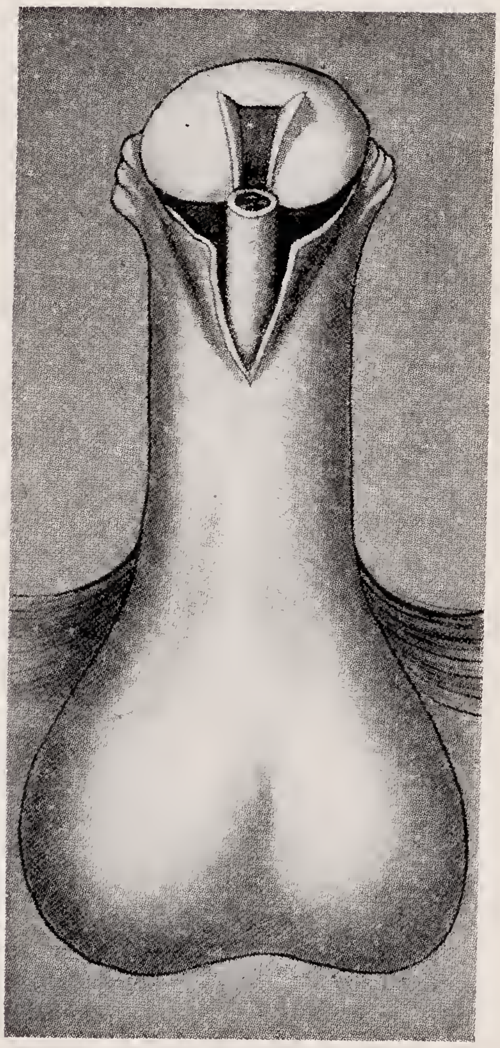

Fig. 65.—Beck.

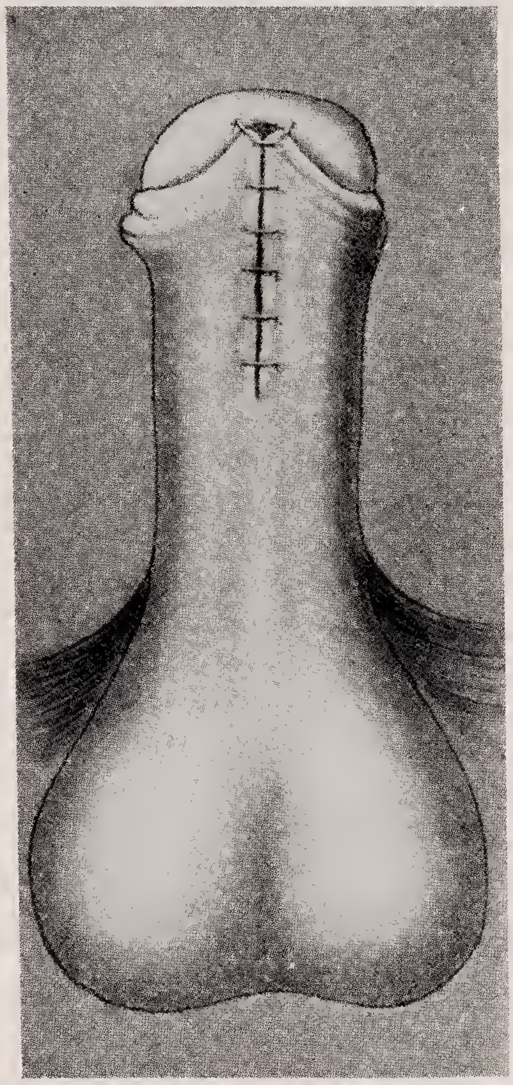

Fig. 66.—Beck.

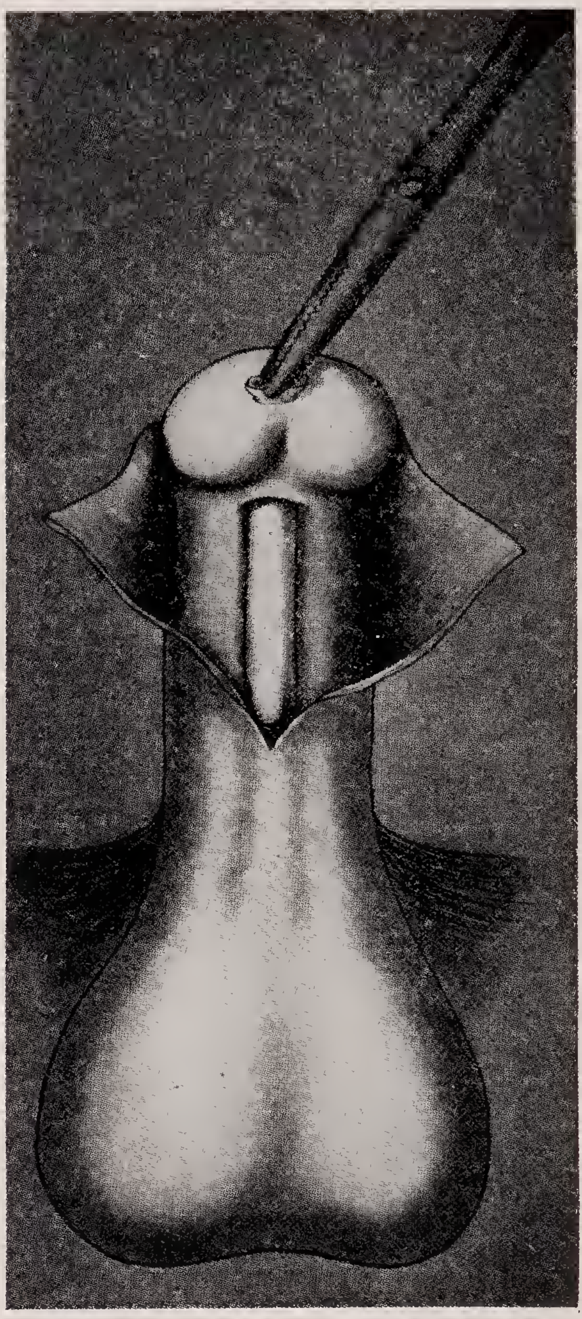

Fig. 67.—Beck.

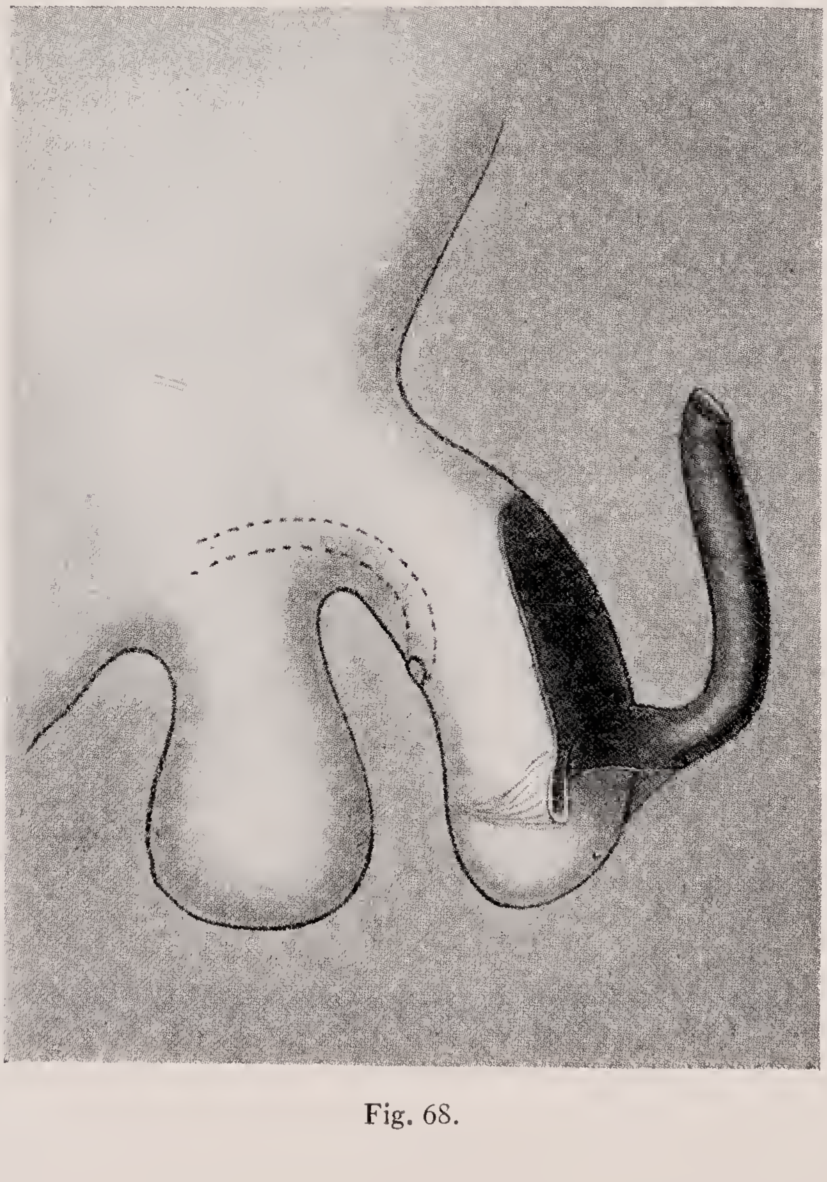

Fig. 68.

and sutured to the opening on the surface of the glans (Fig. 67). The advantages of the method are many. The total length of urethra is normal in its mucous membrane. There is no catheter needed; patients pass urine freely during the healing process, and the wound pursues a normal course of repair free from urinary contamination.

The operation may be performed in cases of mild degree at a very early age. Beck has operated successfully on one infant of five months. While this operation is probably the best one possible for a certain class of these malformations, it must be combined with some other method to make it useful in relieving most of the penile, penoscrotal, and perineoscrotal cases.

The 1899 report of the Heidelberg clinic presents three cases of hypospadias treated by the Beck method, in all of which the retraction of the dislocated urethra curved the glans downward and the meatus delivered its stream below, as previous to operation, thus giving theoretic but not practical relief. According to a later report from this clinic, with a total of 7 cases, better results had been achieved. Ochsner relieves this downward contraction resulting from the Beck operation to a great extent by tunneling the glans at a higher point and bringing the urethra through it, locating the meatus above the apex of the organ. Bardenheuer has been credited with the tunneling by trocar instead of knife, but this was done by Dieffenbach in 1838. Any surgeon who has had experience in this class of surgery feels the necessity of having at his command several methods of procedure, and is well pleased if he can restore the functions of the organ as a whole, regardless of cosmetics, by means of one or a part of several operations. The prepuce in cases of hypospadias is usually redundant and situated on the dorsal surface, overhanging the glans like a hood. The skin of the penis is noted for its thinness, having no adipose tissue, also for its looseness of attachment and elasticity. Where it is folded upon itself at its cervical attachment, its character very nearly resembles mucous membrane. For the past four years we have utilized this membrane to build the tube of urethra in such cases as could not be relieved by the Beck operation used alone. The principle of a urethra of prepuce was devised by Van Hook.

The prepuce is extended as for circumcision, and two incisions are made, about 1 inch apart, extending from its free border to its attachment at the penile cervix; the prepuce is unfolded, forming a loop of thin skin about 2½ inches in length. Should this not be considered sufficient to reach from its attachment to the hypospadiac opening, the two incisions are extended back along the dorsum of the penis until sufficient tissue is obtained, when the two incisions are connected by a transverse one, and the flap of skin lifted but left attached to the cervix by the inner surface. Several sutures now close the lateral integument of the penis over the denuded area (Fig. 68).

The pediculated flap of prepuce is constructed into a tube with its skin or outer surface inside, by means of a number of catgut sutures. The penis is tunneled by means of a narrow bistoury or medium trocar and cannula through the glans, above its groove, along the penis to a point beneath the hypospadiac opening, when it is made to emerge at one side of, but close to, the urethra; the tube of prepuce is drawn through the tunnel and sutured where it enters the glans and also where it emerges (Fig. 69). At the end of ten days the flap of pedicle is cut through close to the new meatus. The second operation, made at a later period, consists of a perineal opening into the urethra and insertion of a Jacobs' self-retaining female catheter; this is the least irritating, and can be left as long as needed—usually from five to eight days. An incision at the termination of the two urethras now admits of accurate coaptation by sutures, or the normal urethra may be mobilized (Beck method) to a sufficient extent to admit of its insertion into the caliber of the new urethra, where it is held by sutures and the external parts closed over this (Fig. 70). Occasionally a little urine escapes into the urethra, and the entire canal is best drained by passing several silkworm-gut strands or horsehair through the urethra and out alongside the catheter in the perineal opening. When union of the canals is complete, the drains are removed and the perineal drainage will usually close itself in a few days. Horsehair and fine catgut have proved the best suture material for this form of plastic work.

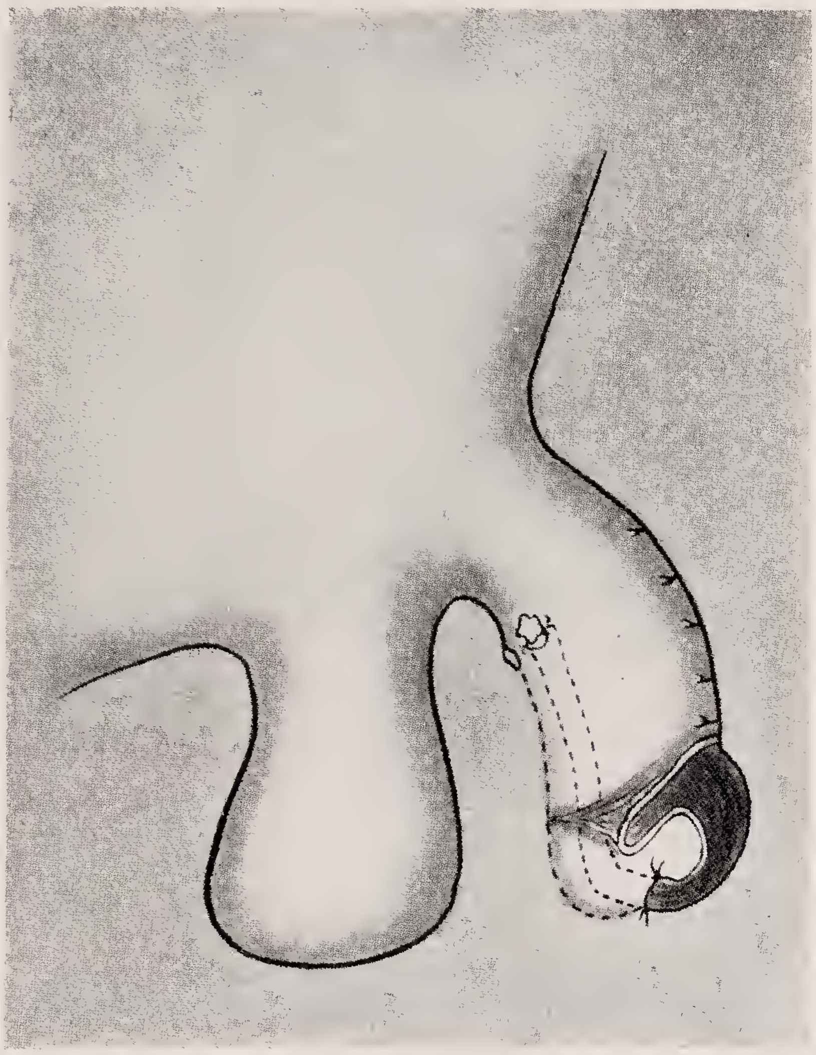

Fig. 69.

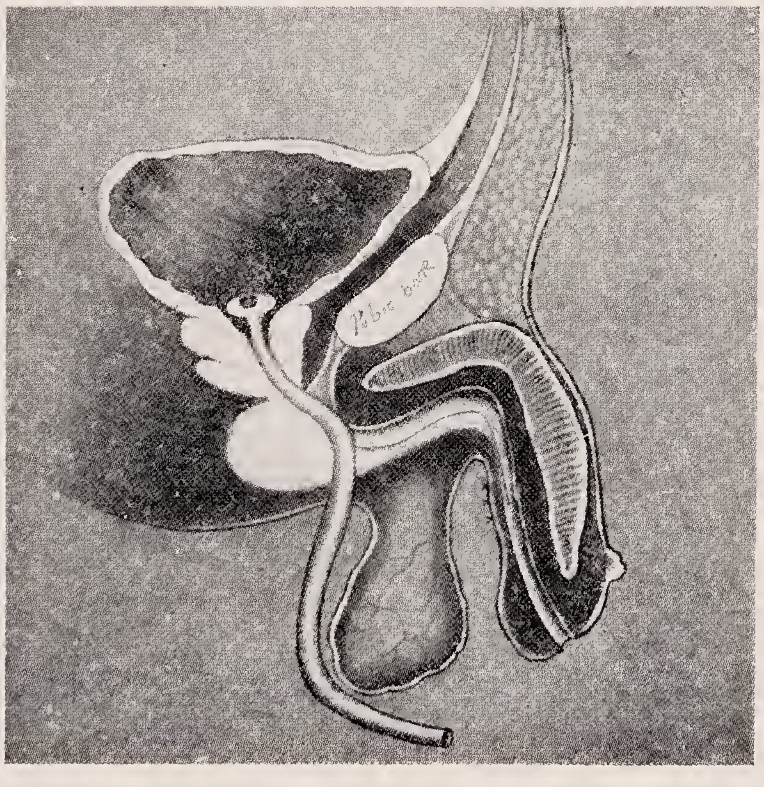

Fig. 70.

The advantages of this combined operation are: (1) A urethral tube of thin elastic skin nearly approaching mucous membrane, yet having no hair surface to occasion later complications; (2) a perineal drain for the bladder, with a self-retaining Jacobs' female catheter; (3) a silkworm drain for the urethra; and (4) in being a method capable of application to the worst types of hypospadiac cases.

The following four cases of hypospadias were cured by various methods:

Case 1.—(St. Mary's Hospital Reports for 1897.) A boy of four years, penile type, was given two operations, the first a Duplay, with partial success; the second a Thiersch, with a good urethra.

Case 2.—(St. Mary's Hospital Reports for 1898.) An adult with the balanic type was given two Thiersch operations, with a nearly perfect result.

Case 3.—(St. Mary's Hospital Reports for 1900.) A boy six years of age, of the perineoscrotal type, with divided scrotum, at the first operation had 2 inches of urethra constructed from the prepuce and skin of the dorsum of the penis; at the second, bladder drainage, a Nélaton catheter in the perineum, but union at the juncture of the urethras failed. Urine passed by the catheter; bladder tenesmus. The third operation gave bladder drainage by means of Jacobs' self-retaining female catheter through the perineum for eight days; silkworm strands in the urethra for drainage. Cure.

Case 4.—(St. Mary's Hospital Reports for 1900.) A boy eight years of age, the penoscrotal type, was given two operations. The first was construction of 1¾ inches of urethra of prepuce and skin from the dorsum of the penis; the second, bladder drainage, self-retaining Jacobs' female catheter through the perineum, and union of the two urethras. Urethral drainage was by silkworm-gut strands. Cure.

HYDROCELE *

CHARLES H. MAYO

At about the eighth month of intra-uterine life the testicle descends to the scrotum. Previous to this time it is situated below the kidney and behind the peritoneum. In its descent it becomes attached to, and takes with it, a fold of peritoneum, which does not invest the entire organ, but infolds it somewhat as the colon is invested, thus giving a parietal and visceral surface to this sac, which is known as the tunica vaginalis. The processus vaginalis, or narrow neck, which connects the general peritoneal cavity with the tunica vaginalis, becomes obliterated, as a rule; but occasionally this process of obliteration is incomplete, and we have various forms of hernia, or a closed sac of peritoneum may result in encysted hydrocele of the cord. A collection of fluid in the tunica vaginalis is what is ordinarily known as hydrocele.

Blood-cysts of the cord from injury have been mistaken for encysted hydrocele of the cord; and cystic tumors of the testes and epididymis, although rare, have also been mistaken for this affection. Such cysts are of slow growth, and when small, are intimately connected with the testicle or epididymis. Larger cysts are more difficult to differentiate, but the fluid is either perfectly clear, or in other cases cloudy from contained spermatozoa. Hydrocele fluid is straw-colored, and corresponds to normal blood-serum. Encysted hydrocele of the scrotum is usually classed with cysts of testes and epididymis.

Hydroceles are translucent, and this point should be elicited in the dark-room as one means of diagnosis. Exploration with the hypodermic needle, as well as the lack of impulse on coughing, is also a valuable aid. In children it is often difficult to differentiate small hernias from varieties of congenital hydrocele.

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* Reprinted from the "Northwestern Lancet," 1901, vol. xxi, pp. 143, 144.

There are several methods of treating the disease, all of which have for their object the more or less complete obliteration of the cavity of the tunica vaginalis. Aspiration of a hydrocele, or tapping, as it is often called, results in an occasional cure, especially in the small congenital hydrocele of children. In other cases it gives temporary relief. Aspiration with retention of the cannula for forty-eight hours, as advised by Neumann, has been successful in many cases. The retained cannula makes continuous drainage, as well as sufficient irritation, for a cure. There is little swelling or inconvenience.

Another method is performed in the following manner: By means of a long needle a strand of catgut is drawn through the hydrocele without incision, and both projecting ends cut close to, and allowed to slip beneath, the skin. This method allows drainage into the cellular space, and cures some cases of low tension and recent formation.

Aspiration, with injection of tincture of iodin, causes a severe plastic inflammation, which results in an adhesion of the parietal and visceral layers of the sac. The quantity used varies from 1 to 5 or 6 drams, according to the size of the hydrocele. The scrotum is immediately manipulated to distribute the solution over the entire wall of the cavity. A few cases are reported in which the excessive irritation caused destruction of the tunic, necessitating an open operation for drainage. In twenty-four or thirty-six hours after injection the tumor is as large as before or even larger, and the patient requires rest in bed for about a week. The swelling subsides in three or four weeks. The pain following injection is severe, and often requires morphin for its relief during the first few days.

Aspiration and injection of carbolic acid, advocated by Levis in 1872, is performed in the same manner, using for aspirating a large needle which will fit a hypodermic to be used for injecting the acid. After removing all the fluid possible from the sac, carbolic acid, as pure as can be obtained in a fluid state, is injected, making use of about two or three drops to the ounce of hydrocele fluid removed, 30 or 40 drops being sufficient for even the largest tumors. This method gives but little pain, and patients are not necessarily confined to the house unless the tumor is an unusually large one. The swelling of the sac which follows the injection disappears in two or three weeks. Probably 75 per cent. or more of ordinary hydroceles may be cured by the injection method. In case of recurrence after injection of iodin or carbolic acid the process may be repeated. A second failure should indicate the open method. Injection methods will fail in most hydroceles of long standing with thick walls which do not admit of total obliteration, some space remaining open as the starting-point of a collection of fluid, which readily separates the adherent walls of the tunic, and the scrotum rapidly regains its former size.

Bartholomew reported a new operation for hydrocele a few years ago. A small incision is made down to the sac, which is separated from surrounding structures by a probe or other blunt instrument. The sac is opened, its edges drawn out of the opening, and a large portion of the parietal layer removed through this small incision, no drainage being employed. In our hands blood-cysts followed about 50 per cent. of the cases and the method was abandoned.

The open or Volkmann operation is one in which an incision is made into the sac, and the cut edges of the tunic sutured to the skin. The sac is then lightly packed with iodoform gauze, which is left for several days. Bland-Sutton adds to this operation the excision of the parietal layer of the tunic. Such operations are nearly always successful.

The purpose of this paper is a description and advocation of an operation employed by Sick, of Hamburg. In this operation an incision is made in the scrotum about 3 inches long, and the sac evacuated and separated from the scrotum, the opening in the tunic extending to its attachment with the cord. The sac is then turned inside out, the testicle being passed through the opening; one or two catgut sutures close the cut edges of the sac behind the testicle, and, with the serous surface now entirely exposed, the testicle is returned into the scrotum. A few sutures close the tunics and skin, and a drain, inserted to the testicle through the walls of the scrotum, is allowed to remain two days. The patients are confined to the house from seven to ten days. We have made a number of these operations, and the results have been ideal. Lanquet made use of much the same method, but now he draws the testicle out of the scrotal incision without separating the tunic, replaces the testicle in the scrotum, but not in the sac, and closes the wound without drainage.

A word in regard to drainage of the scrotum. If gauze is used after any open method, it is very difficult to remove the adhesive inflammation and contraction of tissues holding it fast. We now use the Morris wick, enfolding the gauze in rubber tissue. This wick acts as a perfect drain, is flexible, and is readily removed.

To sum up our experience in the treatment of these cases. Aspiration and injection of carbolic acid is used in recent and thin-walled hydroceles. The method of Sick is employed in cases of long standing with thick walls, and in cases which have failed of being cured by aspiration and injection of carbolic acid. It is also used in case the patient lives at a distance, and consequently might be inconvenienced by the occasional failure of the injection method.

PROSTATECTOMY *

CHARLES H. MAYO

Considered from a scientific standpoint, surgery of the prostate is of comparatively recent date. Statistics made during what might be called the forming stage of prostatic surgery, should be considered only in a general way. During such a period of incomplete knowledge and imperfect diagnosis surgeons lacked judgment as to the best operation for the condition present. As a result, operations were deferred until the patients were nearly moribund; they were hasty and incomplete, because made upon the worst cases, where the symptoms demanded immediate relief, the condition itself being one occurring upon the declining side of life, when sclerotic arteries and degenerative changes, especially of the kidneys, are common. If one places dependence upon statistics, palliative operations were more fatal by far than the more recent operations for radical cure. Present statistics to a large extent indicate the judgment and skill of the operator in diagnosticating conditions and choosing methods of attack suitable to the case. The surgeon who adjusts the operation to the patient, and not the patient to the operation, is the most successful.

Most of the literature upon the subject of prostatic surgery has been written by operators who advanced some special method of operation or plan of attack, regardless of the indications.

It is unnecessary to dwell upon the diagnosis of these cases. Every male over fifty years of age who complains of frequent micturition of small amounts, sudden stoppages of flow, and these symptoms extend over some period of time, or reports that total retention has occurred, requiring catheterization or aspiration,

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*Read before the Minnesota Academy of Medicine February 5, 1902. Reprinted from "The St. Paul Medical Journal," April, 1902.

leads the surgeon to at once think of prostatic hypertrophy or stone. The diagnosis is completed by rectal examination, sounding of the bladder, and the examination of urine passed, which determines the question of cystitis and its character. By passing a catheter, while one finger is inserted in the rectum, the depth of the prostatic urethra can be estimated by the distance traversed in the prostatic portion before the urine flows. The quantity of residual urine is now found, also the condition of the bladder muscle, whether atony be present or not, also the size of the bladder by irrigation. The cystoscope will be of practical use in a number of cases.

If the diagnosis determines the condition to be surgical, the next important step is the general examination of the patient with regard to the condition of the heart, arteries, and nutrition, general appearance, and advanced age. An important factor is to find the relative proportion of urine passed during the night as compared with that during the day. The danger of uremia in those who have high-tension arteries, quick-closing heart valves, and contracted kidneys, which secrete two-thirds of the twenty-four hours' low specific gravity urine at night, is greatly to be feared.

After such an examination we can establish a fairly accurate ratio between the disability, on the one hand, and the dangers to be incurred and benefits to accrue from operation, on the other.

The use of a catheter once or twice a day may be recommended in certain cases, with such restrictions as to its care as can be impressed upon the patients. Few individuals lead a comfortable catheter life, and those who obtain relief for long periods in this manner only impress upon our minds that the average catheter life is from four to six years. In many cases it will not be necessary to give any treatment further than general or hygienic.

Meyer has classified the various methods of operating for prostatic hypertrophy into direct and secondary.

Of direct methods, we have suprapubic, subpubic, urethral, perineal, and sacral routes. Mercier's method of prostatotomy, injections into the gland, stretching, and massage. Electrically, we have galvanic and cautery.

The more indirect methods are castration, vasectomy, and Bier's operation of ligating the internal iliac arteries. Of the various methods of suprapubic operation we have:

1. Suprapubic prostatectomy without perineal drainage (McGill).
2. Suprapubic prostatectomy with perineal drainage (Fuller).
3. Suprapubic prostatectomy with perineal section and drainage (Belfield).
4. Suprapubic cystotomy with perineal prostatectomy without perineal drainage (Nichol).
5. Suprapubic cystotomy with perineal prostatectomy and perineal drainage (Alexander).

A careful review of the general literature of the subject would indicate that about one-half of enlarged prostates can be reached either from above or below equally well, according to the skill and inclination of the operator, that about one-fourth can be performed better from above and one-fourth better from below, and from anatomic or pathologic conditions the combined operation will be necessary in certain cases.

There is not much material difference of opinion among the numerous writers upon the operative and autopsy findings of enlarged prostates. Watson states that the most common location of enlargement is bilateral and median, unilateral with median or separate pedunculated growths being rare. This about conforms with the statements of Sir Henry Thompson and Dittel, while McGill lays some stress upon the uniform circular hypertrophy. Alexander, from a larger number of autopsies, presents the most practical points from an operative standpoint:

"The layer of prostate behind the urethra does not enlarge. The enlargement occurs in the lateral and developing middle lobes. The lateral growths depress the urethra; the middle raises its inner posterior end, thus increasing the length and curve of the prostatic urethra. The lateral lobes are nearly always encapsulated and glandular. The middle enlargement may be of three varieties:

"First, muscular—those cases with a bar; second, glandular and then encapsulated; third, hypertrophy of mucous glands and bladder tissue."

Our choice of operation will be influenced by known and unknown conditions. Could we accurately diagnose the cases of muscular bar, the prostatotomy of Mercier or the Bottini cautery operation could be considered, but to cut through the capsule of a glandular enlargement and not remove it is surgical insult.

Of known conditions which influence our choice, the fleshy individual with thick perineum, long prostatic urethra, and high lying prostate is one in whom a suprapubic or combined operation will be indicated. Those with large dilated bladders may be reached by suprapubic incision, while the stiff-walled, contracted bladder is possibly more suited to perineal attack. Those with stone present and unknown condition of the bladder, but presumably with enlarged prostate, are best explored from above. Those who have had a previous suprapubic cystotomy for stone or drainage are best made from above.

By unknown conditions we are influenced as well; for instance, in cases of symptomatic stone, yet none found by search, but with known enlarged prostate, suprapubic incision gives better bladder exploration.

In the emergency operations made in the country, where retention is present and immediate relief demanded, but neither time nor facilities possible for careful examination, the suprapubic opening is indicated. Those with cystitis and old or acute secondary changes in the testes—and such cases are not rare—will often improve greatly from castration.

We still have a large class of prostatic sufferers in whom there are no symptoms of stone, little or no cystitis, and short perineal distance, in whom a perineal operation is unquestionably the better method.

The ease of operation, perfect drainage, and earlier recovery in chosen cases no doubt justifies this choice, the special retractors of Ferguson and Sims simplify the accessibility of the gland from below, and it is quite possible, from present indications, that this method will be developed into the operation of the future by making earlier diagnosis of conditions and operating before these cases reach the stage of necessary suprapubic incision. The perineal operation may then bear about the same relation to the suprapubic that the radical operation for hernia does to the radical operation employed in cases of strangulation.

Suprapubic Operation

After the usual preparation for operation $\frac{1}{6}$ grain of morphin is administered hypodermically one-half hour previous to operation; this generally reduces the amount of anesthetic required.

Anesthetic: Ether preferred, but chloroform more often indicated.

Position: Trendelenburg. A catheter is inserted, the bladder irrigated and inflated with air, and a rubber band applied to the penis to retain the air-pressure. This method of Bristow's has displaced fluid tension and the Peterson rectal bag, and ordinarily gives from 1½ to 3 inches of space between the peritoneal fold and the pubic bone.

A vertical or transverse incision is made down to the recti muscles, with blunt separation of recti and digital separation of areolar tissue above the bladder, which is easily felt, the wound retracted, and two sutures applied to the bladder-wall, which act as tractors; the bladder is incised and digital exploration made. If it is considered best to complete the prostatectomy from below, the superior opening is used to force the gland down upon the enucleating finger in the perineum. Should the operation be made from above, the tendons of the recti muscles are cut laterally ½ or ¾ inch each side of the incision. The bladder incision is enlarged, and a blade of the scissors is passed into the urethra and the other over a projecting lobe and the capsule incised, the enucleation being made with the finger. Single pedunculated tumors are removed with scissors, cold snare, or by morcellation. This latter method is not employed if it can be avoided, as it leaves tags of tissue which must undergo necrosis. An assistant can make strong perineal pressure and upward pressure with two fingers in the rectum against the prostate, or the operator can temporarily employ a rubber glove on one hand for this purpose.

Muscular bars are treated in sight, by cautery or prostatotomy. Hemorrhage, the bugbear of surgeons in this work, may necessitate a gauze pack, which must be so placed as to be brought out above, or by perineal incision, or in form of a circular pack fastened to a thread passed through the urethra and drawn out through the penis, when removed as done by Keyes. The Witzel method of closing the bladder by folding its wall over the tube for drainage is very successful in preventing leakage in suprapubic drainage. Where from certain conditions this cannot be done, the automatic siphon suction apparatus of Dawbarn is very useful. Some operators fasten the bladder to the abdominal incision. This favors a lack of drainage in the space of Retzius, and after recovery these patients complain of pain at urination, the concentric muscle-fibers then working from two fixed points—the base and the point of attachment above.

The suprapubic operation requires from three to five weeks' hospital care, although in the aged it is best to get them out of bed as soon as possible.

Perineal Operation

With regard to the various perineal operations upon the diseased prostate, there are but two methods which are at present advocated: They are the median and the curved transverse or trap-door incision, made with the patients in the lithotomy position. Those who use the median incision dilate the wound as much as possible, and, after incising the capsule and partial separation of the enlarged mass, employ morcellation forceps for its removal. A tubular drain and gauze pack complete the operation. The transverse curved incision is one giving much more room, and is altogether more satisfactory. Commencing on one side, between the anus and the tuber ischii, it passes forward to a median point back of the bulbar prominence, and then to a point upon the opposite side of the anus near the tuber ischii. Such a wound, when deepened to the prostate and the rectum pushed back from its attachment, has the general shape and size of a large vagina. The capsule over the prostate is incised transversely and caught beneath the posterior retractor. The glands are separated by the finger, and hook cat's-paw retractors employed to roll the tumors out of their position. Sims makes use of a water-dilated rubber ball, which is passed into the bladder empty through an opening in the membranous urethra, and drawn through the perineal wound by its connecting rubber tube. Ferguson uses a special staff retractor, passed through the penis and serving as a urethral guide, and also to force the various lobes into the wound. A No. 16 sound has proved very satisfactory for this purpose. A large tubular drain into the bladder and gauze packs of prostatic cavities are brought out one side of the incision, the balance of which is closed by suture. The drainage and pack are left for an average of six days.

SURGERY OF THE PROSTATE *

CHARLES H. MAYO

In a paper presented before the Western Surgical Association, December, 1901, on suprapubic prostatectomy, I stated that about one-half of the enlarged prostates could be removed equally well from above or below the pubic bone, one-fourth better from above, and one-fourth better from below. The experience of the past eighteen months has led me to modify these conclusions. We now do the major part of prostatic operations from below, reserving the suprapubic incision for such conditions as more directly involve the bladder itself, such as intravesical tumors, including pediculated median prostatic enlargements, when the lateral lobes are but little enlarged, and for stone when the prostate is not especially involved.

Instead of recommending operation only in the most severe cases because of necessity, it is now advised as a matter of expediency in cases with more or less distressing symptoms. The statements made in some of the late text-books that removal of the prostate should not be employed except in cases which have proved intractable to careful and prolonged catheter treatment is certainly wrong when viewed from the standpoint of modern surgical progress. Such a conception of the subject has much to do with the imperfect results, as well as the mortality, following operations upon this gland. Catheter treatment sooner or later leads to bladder infection, and dormant kidney infection may become a serious complication. Careful consideration of the anatomy of this region has led to the present small operative mortality, as well as the short period of disability and relief from distressing symptoms.

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* Reprinted from "Trans. Minn. State Med. Assoc.," 1903, p. 167.

With the exception of its base, which is a nearly fixed area, the bladder is an extremely movable organ, depending more upon the changes in the size of the rectum than upon the distention of the organ itself. The lateral walls are supported by the peritoneal folds on each side, and the apex, to a certain extent, is bound to the abdominal wall by the urachus. The muscular coat is composed of three imperfectly separated layers, the middle stratum being arranged in a circular horizontal manner at the base, about the urethral opening, and is called the *sphincter vesicæ*. Just behind the urethral opening the bladder-wall bulges into the cavity of the viscus, the enlargement being caused by the middle lobe of the prostate, and when quite prominent, as is frequent in old men, is called the *uvula vesica.*

The prostate is a partly muscular and partly glandular organ, surrounding the urethra at the base of the bladder. The transverse diameter is 1¼ to 1½ inches. Its anteroposterior is ¾ inch, and the vertical 1¼ inches. The shape is that of a Spanish chestnut with the apex down. The urethra enters near the center of its upper surface, and passes through the gland in a curved direction, with the convex surface posterior, to emerge just above and in front of its apex. The common ejaculatory ducts enter together in the middle of the posterior surface, and open into the urethra. The portion of the gland above these ducts and behind the urethra is called the median lobe. The gland is surrounded with a dense fibrous capsule, which contains the venous plexus and is continuous with the rectovesical fascia. The male perineum is the shape of a heart, with the central common tendon point a finger's-breadth in front of the anus, and this is continuous with the triangular ligament anterior to this point. One inch in front of the anus is the posterior edge of the bulb of the corpus spongiosum. The membranous urethra is located just in front of the prostate, and lies 1 inch behind the symphysis pubis. The gland weighs a little over ½ ounce, and when the weight exceeds 1 ounce, it may be considered abnormal in size.

The character of the local pathologic condition is a secondary question. The organ being one of mixed tissue, the younger the patient, the more probable the condition is that of adenoma. In older patients there is a hyperplasia of the muscular element, with more or less fibrosis; true adenomata also occur. The first symptom of obstructive change is a diminution of the force and increase in the frequency of micturition. The relief afforded by urination is incomplete, even after repeated efforts. The bladder-wall develops a compensatory hypertrophy. Night-rest is disturbed by the frequency of urination in this condition, while in stone in the bladder the disturbance is greater during the day, although both conditions may be associated. There is usually a feeling of weight in the perineum. The bladder finally dilates, and a condition of chronic partial retention exists. The secondary complications are now probable, such as hemorrhoids or prolapse from congestion and straining, even hernia being sometimes induced.

Dilatation of the ureters may be caused by back pressure, and, the bladder being continually full, only the surplus escapes at urination and at night in sleep, and if there is this overflow, it is miscalled incontinence. The final and most dangerous condition is infection and the danger from cystitis and ascending urethral infection, death following from pyonephritis.

Examination.—Digital examination by the rectum will disclose the apparent size, density, and contour, whether smooth or nodular. Bimanual examination is often of aid in making a general estimate of the size or bladder encroachment of the tumor. The sensitiveness is also noted. With the finger in the rectum, a moderately hard catheter can be passed, and the distance traversed from the membranous urethra until the urine flows will give an estimate of the prostatic distance, all above 1¾ inches being in excess of normal. In subjects who have but little enlargement of the lateral lobes, with symptoms of obstruction and a long prostatic urethra, the middle lobe is probably enlarged.

The cystoscope is often of great service in clearing up questions of doubtful diagnosis in regard to stone or vesical tumor.

In our experience the soft or elastic prostate, as felt by the finger, occurs in recent infection and in foreign bodies in the bladder, the apparent large size being due to venous congestion in the capsule. Tuberculous prostates are found in younger patients, usually between twenty and forty-five years of age. There is often associated tuberculous disease of the epididymis or other regions. Bloody urination is present at intervals, and the tubercle bacilli can usually be found by sedimentation of the urine.

The cases of cancer of the prostate which have come under our observation have occurred with more acute symptoms of obstruction and distress, without the usual history of chronic enlargement. The tumor is nodular, sensitive under examination, and may be unilateral in the earlier stage. The ages of patients have been between fifty and sixty-five years.

Suprapubic opening is made in cases of tumor of the bladder, and when the enlarged middle lobe, with small lateral lobes as felt in the rectum, is considered to be the source of obstruction. Suprapubic incision is also employed in cases of stone in the bladder in certain aged individuals whose general health and progressive disability are out of proportion to the local findings of a chronic prostatic hypertrophy. The removal of the stone and drainage will establish such improved general condition and bladder tolerance that a perineal operation for the prostatic removal can be made at a later period, with greatly lessened risk. This is also true in cases of acute obstruction, in which the urethra is slit with false passages, and the patient in no condition for extensive operative interference, and in cases of acute infection with obstruction or extreme general disability. Drainage can be readily established, and bladder tolerance secured by trocar and cannula, leaving the cannula in the suprapubic position for several days. All other conditions of the enlarged obstructive prostate are attacked from the perineum.

In our earlier perineal operations we made the transverse horseshoe incision; later, the inverted "Y." While these incisions give much space for manipulation, there was always some hemorrhage at the time and considerable oozing afterward. The earlier steps of the operation seemed needlessly severe for the simple enlargements by reason of the extensive exposure of the arterial supply and the venous plexus about the capsule. However, it is without question the better plan for the surgeon without experience in this operation to gain it through the "Y" or transverse curved opening until the anatomy of the region becomes familiar. The ordinary methods of opening the capsule by a transverse or two vertical incisions preserved the urethra for a short time only, to open it later in the operation. We now make a short median incision within a half-inch of the anus, and, after exposing the bulb, a dry separation is made to the membranous urethra, which is opened on a sound and the finger inserted into the bladder. This outlines the growth, and, with the finger still in place, a short hook knife, not unlike a pruning-knife, is passed beside the finger, and the urethra opened into the prostate posteriorly on either side from the bladder out, incising the capsule; next, the membranous urethra slightly as it is withdrawn. With the finger still in place, two more incisions are made on both sides of the prostatic urethra, with the cutting surface directed parallel with this portion of the passage. The last incisions are at right angles with the first, and separate the urethral walls from the gland. The two lobes are now shelled out of the prostatic capsule with the finger and left *in situ* hanging from the bladder attachment. The finger also separates the urethra from each lateral lobe through the vertical incisions. A three-tined hook cat's-paw retractor is inserted, or the spoon-blade stone forceps employed, and one lobe will be drawn down with one or the other of the lateral. A very hot wet sponge of gauze is pushed into the capsule and left for a few minutes to check oozing, and a short rubber-tube drain inserted into the bladder, with which it is now irrigated. The perineal wound is closed by a couple of sutures, and the bladder drain is removed on the third or fourth day. If there is much bladder tenesmus, a Jacobs' self-retaining catheter is inserted through the perineal incision. The patient should be on his back during the operation, with the legs flexed and forcibly compressed against the abdomen. This very materially shortens the perineal distance and produces some intra-abdominal pressure in a favorable direction. This plan of operation is similar to the principle advocated by Goodfellow, who probably was the first surgeon deliberately to attack the prostate through the perineum in 1891. From January 1, 1903, to June 15, 1903, at St. Mary's Hospital, we have removed 17 prostates through the perineum. Three of these cases were complicated by stone, the removal of which was easy through the small incision. The ages of the patients were between fifty-five and eighty-two. Two patients were operated for stone by suprapubic incision: one, being too debilitated for prostatic removal at the time, was to return for a perineal removal of the gland, the other was a paralytic. One case was drained by suprapubic trocar and the cannula left in place for a week, when the prostate was removed.

One prostate proved to be carcinomatous. All of these patients recovered from the operation and were relieved of their suffering, though the patient with carcinoma will undoubtedly have a recurrence. One advanced case of cancer of the prostate was not operated. A temporary epididymitis occurs in a small percentage of cases, but the inflammation is of short duration, as a rule.

THE TECHNIC OF SHORTENING THE ROUND LIGAMENTS *

CHARLES H. MAYO

In certain cases of uterine retroversion or flexion, or both, in which it is desirable to open the abdomen for purposes of exploration or to relieve the local or general pathologic conditions, it becomes a question how best to restore the normal position of the uterus. The description of a simple method, or rather a combination of parts of several methods, which we have employed in many cases during the past two years, may be of interest.

With the patient in the Trendelenburg position, the hand is inserted through a 3- or 4-inch median or slightly lateral incision in the lower abdomen, and passed into the upper abdomen to explore the region of the gall-bladder. As the hand is withdrawn the cecum is brought into the wound and the appendix examined. After dealing with such pathologic conditions as are found the pelvis is isolated from the general cavity by a gauze pack and examined. This is done at first, as conditions may be present here which would render the preceding examination one of considerable danger if done later.

The uterus is now placed in a normal position. This step may require the separation of adhesions. At the lower angle of the incision a pair of curved forceps, Cleveland ligature carrier, or other similar instrument, is passed laterally beneath the aponeurosis, just over the muscle, to the point where the round ligament leaves the abdomen. This is facilitated by lifting the wall of the abdomen out and up with a tractor, also drawing the ligament tight with the forceps from within. The handle of the instru-

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*Reprinted from "Surgery, Gynecology, and Obstetrics," February, 1906.

ment is now elevated, and its point, seen from within, is made to pass over the pulley of the round ligament, not under it, and only beneath the peritoneum. It is made to traverse the true course of the ligament, passing with it beneath the peritoneum, and when one-third or one-half way to the uterus, it is pushed through the peritoneum, and the ligament grasped at a point from 1½ to 2½ inches from the uterine horn, according to the amount of slack present and the breadth of the pelvis. This loop of ligament is withdrawn with the forceps.

A similar procedure is repeated at the same point on the opposite side. The loops are now ligated together at the lower angle of the abdominal wound. Some operators may prefer to pass the ligature around the ligament first, and, grasping the suture on each side instead of the ligament, using the same to withdraw the loops, as in the former procedure, the two ligatures being tied together in the lower angle of the wound. Others may prefer to grasp the ligaments from beneath the peritoneum and make this part of the operation extraperitoneal. If the folded ligament does not reach to the midline, they are sutured to perforations in the aponeurosis.

Suture material may be chromic catgut or linen. The peritoneum is closed by tier suture of catgut, supported at times by figure-of-8 silkworm gut in the aponeurosis. At the lower angle the aponeurosis is united to the ligaments by the closing sutures. The operation is quickly made. The intra-abdominal pull is the normal one over the true pulley. Its outer course is beneath the aponeurosis and over the muscle, and becomes fixed only one inch above the spine of the pubic bone, its normal point of exit from the canal.

Uterine displacements, when complicated by sepsis, are relieved by other methods.

EXTERNAL (SKIN)

SKIN-GRAFTING *

CHARLES H. MAYO

To the success of skin-grafting and transplantation are due similar operations performed upon nerves, tendons, and other tissues of the body. For ages past plastic surgery has consisted in the immediate apposition of wounds of the soft parts, and in cases of severed ends of fingers, noses, or portions of ears; the adjustment was followed by a happy result in sufficient instances to promulgate the idea that it was a possible feature of surgery. The usual healing of wounds was by cicatrization. A general classification of plastic work given in Ashhurst's "Surgery" is short and complete:

1. All those in which the borrowed piece is transferred directly to the seat of future residence, retaining for a time by means of a pedicle connection with its former site.
2. Those by which the autoplasty is accomplished after the method of Roux, by successive migrations of the flap from a point more or less remote.
3. Flaps derived from the neighborhood moved by gliding, stretching, or flapping.
4. By approximation, as in ectropion.
5. Readjustment of totally severed parts. The modern application of skin-grafting is included in this fifth class.

Hamilton claims priority for the principle of skin-grafting. In 1854 he performed a plastic operation for the cure of an old ulcer of the leg, using a pediculated flap from the calf of the other leg, not cutting the pedicle until the flap had become attached to its new surface. He had proposed a similar operation to a

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* Read before the Minnesota Academy of Medicine, March 1, 1893. Reprinted from "Northwestern Lancet," April 15, 1893.

patient in 1847 but was refused. Hamilton's case and operation would come under the first class in plastic work; but it furnished a nidus for thought in this direction, and our aspirations have grown with increased knowledge.

In 1869 M. Réverdin transplanted skin with success, and in the following December he raised the discussion: "Is the growth of skin due to contact or neighborhood, referring to a sexual possibility of cells, or due to proliferation of the transplanted element?"

That a healthy granulating surface was an important although not a necessary element for the successful transplantation was proved by the fact that such cases were successful with all forms of dressing and without antiseptic precautions. Bryant speaks of leaving the surface uncovered for a few hours until lymph forms. In 1870 Pollock received credit for his generalization of the Réverdin operation, and in his papers and the discussions of that time it is described as one of the most successful operations known to the surgery of that period. The modern method of the Réverdin operation is essentially as follows: From a healthy portion of the skin small pieces the size of a hemp-seed are excised down to the papillary layer of the skin, or even to the subcutaneous tissue, if none of it be removed. These pieces are placed upon the healthy granulating surface at a distance of ¼ inch from its margins, and an equal distance from each other. In many of these cases a sort of pellicle of lymph exists over the surface of the granulations; we have been most successful in scratching through this where the grafts are placed, just sufficient for blood to show, then inserting the grafts and applying rubber tissue, this being covered with a moist aseptic dressing. These small grafts shed the cuticle, becoming almost invisible, but in a few days bluish-white islands are seen at points where the grafts have taken. Excessive granulations are reduced by caustics.

While this operation greatly facilitates healing, the resulting cicatricial contraction of the scar is but little modified. This method is one of wide application and has been in universal use for the past twenty years. With the fact in mind that these bits of skin would grow when transplanted, it was but a step to remove tissue from amputated limbs and dead bodies. E. P. Brewer found thirty-six hours to be the limit of vitality in such cases. George Martin proved that grafts could be kept ninety-six hours at a temperature just above freezing in salt solution, and successfully grafted. It was but a slight change to hetero-epidermic and zoö-epidermic grafting, frog skin being most commonly employed in the latter method, but the scars formed have the least vitality. Skin-scrapings dusted over a granulating surface have been rarely successful.

With the advent of asepsis in surgery J. R. Wolfe developed the Réverdin method to the transplantation of the whole thickness of the skin, with the idea not of growth by extension, but of growth upon its new surface to have it adhere to and become a part of surrounding structures. In the Wolfe method all the fat and subcutaneous tissue must be carefully dissected from the flap, and the section removed must be one-third larger than the space to be filled to allow shrinkage of the flap, as any tension in its suturing will impair the result. This method is admirably suited to plastic work about the forehead, cheeks, and nose, where the bones are intact.

Fisher healed ulcers of the leg by grafting the entire thickness of skin, reporting cases in 1880. Ollier is reported as having successfully used this method in 1872.

Ceci does not transplant at once, but raises the flap, inserts rubber tissue beneath it, and waits two or three days for granulations to appear upon its under surface; he then prepares the place for its reception and makes immediate transplantation.

By the use of two sizes of the Keyes' cutaneous punch Prince Morrow removes moles, warts, and epithelial growths with the smaller, and removing a section of skin for transplantation with the larger, accurately fits it in its new habitat. He reports cases of removal of scar tissue from the scalp and transplantation of skin with hair-bulbs, securing a successful result.

Senn recently reported the successful transplantation by the Wolfe method of skin from the inside of an arm, to form the upper eyelid and brow.

Wölfler has employed grafts of mucous membrane in cases of stricture of the urethra. In operations upon the conjunctiva, the esophagus of pigeons, bladder and stomach of frogs, and occasionally the recently removed prepuce from a healthy child has been employed. In urethroplasty it is important that the urine should be kept acid, as such urine is usually aseptic.

Erberto Aievoli, in reporting a new method of wound covering advanced by himself, says: "The well-developed testes of an animal recently castrated are cut into thin slices and small pieces spread over the surface by the Réverdin method, and he thinks the good results obtained due to biologic activity of cells implanted."

Concerning the Thiersch method, as one writer expressed himself with regard to the Réverdin process, "In the journals will the work of the grafters be found," an evidence of the zeal with which the medical profession accept new ideas.

Thiersch proposed this operation as early as 1874, and presented the subject to the German Congress of Surgeons. It received but little attention until, in 1886, he again opened up the subject, presenting cases and describing the methods used by him successfully. The operation consists in removing thin shavings of the superficial cutis just down to the papillary layer, varying from one-third to one-half the thickness of the skin.

In recent wounds applicable to this method of grafting it is best to complete the operation at once, uniting the edges of the skin to the tissues beneath by sutures of catgut. In cases where the skin is movable or where tension has been placed on the surrounding integument, silk should be used, for otherwise the catgut will be too early absorbed, allowing one-fourth to one-half inch of granulating surface exposed between the grafts and skin margins by retraction of advanced skin. This method is admirably adapted to granulating surfaces, as in secondary operations and in cases of extensive burns. In such cases the granulating surface requires a thorough scrubbing in bichlorid solution, or in some cases balsam of Peru applied as a daily dressing for a few days previous to the grafting will render them more healthy. If the granulations are exuberant or rough, or washing but imperfectly removes the lymph usually present, they are best shaved with a sharp scalpel and its margin cleaned with a Volkmann spoon.

"Still further microscopically two layers of granulation tissue are discernible, the more superficial possessing vertically disposed capillaries; the deeper containing a horizontal network of vessels from which the former spring, coursing through a structure more or less dense, according to its age, *i. e.*, stage of conversion into connective tissue. A free removal of this upper soft layer of granulations, yet capable of full contraction, must be effected to prevent cicatricial distortion and the risk of separation of the epidermis, these evils being avoided by laying the grafts directly upon the layer of granulations with horizontally disposed capillaries" ("The American Text-book of Surgery").

The oozing from the surface to be grafted is best controlled by compresses wet in hot salt solution. We require a quantity of solution of sodium chlorid, 6 : 1000, which, after boiling, is placed in two dishes, one kept hot, the other cold; a third dish may be kept at a blood-heat by combining the other two. Our tractors applied and the skin stretched, the razor, flat side down, is placed with the back to the end of one retractor; tilt the razor at an angle of 45 degrees from the skin, and continue a rapid sawing motion until the edge of the blade enters the superficial layer of the skin; then drop the blade nearly flat, and continue the same motion, gently forcing the blade forward: the outer layer of the epidermis bunches up on the razor; your assistant keeps it wet with salt solution by holding a saturated pledget of cotton over the field of work, allowing a rapid dripping of the solution upon the blade. Shavings of an average width of 1½ inches and several inches long are readily cut, as when the razor has approached the opposite side of space the tractor can be quickly raised, set two or three inches back, and the tension continued. While some writers direct that these shavings should be all cut at once and placed in a dish of salt solution and then applied, we found, by actual experience, that nearly one-half the time of the operation was expended in uncoiling the previously cut shavings, which roll up skin side in. We now graft directly from the razor by sliding flat upon the wound and holding graft with probe as the razor is withdrawn. It is an essential feature that every portion of the granulating surface be covered, while it is of no importance if grafts overlap each other.

Instruments.—But few instruments are required; one or two freshly sharpened, heavy razors, ground flat on one side; sharp scalpels; a pair of small, mouse-tooth forceps; a pair of scissors for fitting grafts; a probe, and a pair of skin tractors. These last are prepared by taking two strips of wood, ¼ inch thick, 2½ inches wide, 6 inches long; drive 6 needles equal distances apart through one end of each strip ¼ inch from the end, allowing needle-points to project about ⅛ inch. We much prefer these to hands or bathing mittens, as they render the field flat and grafts are cut of uniform thickness.

Dressings.—Cut strips of rubber tissue ¾ inch wide, and long enough to cross the wound each way; also one piece large enough to overlap wound 2 inches each way; soak in bichlorid 1 : 1000 overnight; then place in salt solution. After the grafting is completed, the strips of rubber tissue are laced over, first one way, then the other, until the surface is covered; this allows sufficient drainage. Then two thicknesses of lintine just large enough to overlap the wound edges are applied wet with salt solution; over this comes the large rubber tissue with a layer of cotton. This is now fastened by one or more strips of adhesive plaster to prevent movement of dressings, a bandage applied, and instruction given the nurse to raise the outer edge of the tissue and pour under a solution of the salt of the regulation strength; this is repeated every four to six hours for the first week. All dressings are removed every two or three days and readjusted. At the end of the first week, if the grafts have taken, our surface is covered and already sufficiently strong for a vaselin dressing. The surface from which the grafts were removed may be treated in the same manner, but without change of dressing, and healing usually occurs within a week.

To appreciate the wonderful application of the methods of today we refer to cases reported by noted surgeons of but a few years since. In 1879 W. T. Bull covered the leg and outer part of thigh with new skin by means of small grafts, 1200 being used during six months. In a case of the loss of a scalp W. L. Bradley renewed the entire covering, it taking him eleven months to complete the work, 795 grafts being used.

W. Symington Brown replaced a scalp by using small grafts, beginning in 1873; the treatment extended over three years, and 2600 grafts were applied before the cure was complete.

I will remind you of but one more case, that of Schaefer, of Chicago, who presented the patient at the Ninth International Medical Congress in July, 1886. The woman suffered the loss of the entire scalp, which was replaced by the Réverdin method during the next twelve months, 4500 grafts being used.

The literature of the subject presents many similar cases, and some of recent date treated by the old methods. Just compare these repeated operations with the modern methods, by which similar cases would be healed in a comparatively short time and without the contraction incident to cicatrization.

During the past two years we have made extensive use of the Thiersch method of skin-grafting, over 20 cases being subjected to this treatment. It is an excellent plan of caring for cases of excision of the breast where the tension is considered too great to close up approximation; in cases of sarcoma involving the superficial structures; in cases of removal of eye and lids for malignant disease, and we have found it especially serviceable in some cases of lupus which had resisted prolonged treatment. By using a scalpel and curet, removing all the diseased tissue and making immediate grafting, we have been enabled to heal these cases in from ten days to two weeks. It is a method which, with ordinary care, will invariably be successful, and we have found no difficulty in grafting surfaces varying from 1 to 24 square inches upon muscles, tendons, cartilage, or bone.

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VASCULAR SYSTEM

ANEURYSM *

CHARLES H. MAYO

True aneurysms are those in which one of the coats of the vessel is intact in forming the sac; it may be sacculated, projecting from the side of the vessel and connected with it by a large or small opening, or one or more of the inner coats may project through the outer, forming a hernial aneurysm.

Tubular or cylindric and fusiform aneurysms are the same and consist of the uniform dilatation and growth of the whole lumen of the artery. Dissecting aneurysm separates the coats of the vessel; all these forms of aneurysm may rupture and become diffuse. The predisposing cause of true aneurysm is some form of degeneration of the arterial coats. Traumatic aneurysms are produced by wounds or traumatism of arteries from within or without; they are diffuse or circumscribed, and may, by rupture into an adjoining vein, become arteriovenous, known as aneurysmal varix. Varicose aneurysms are those in which an aneurysmal sac ruptures into a vein, the sac intervening between the artery and vein. Traumatic aneurysms are false aneurysms having no arterial coats around them, the sac being composed of lymph, fibrin, and connective tissue. Diffused aneurysms are inclosed by a sac of the same character.

Death occurs—(1) From rupture of the sac. (2) From pressure on important organs. (3) From sepsis. (4) From embolism. (5) From gangrene of extremity by occlusion of the vessel.

Cure may occur by occlusion of the vessel, by an embolus or clot of the blood in the sac, or by deposit of fibrin. Efforts have been made to cure aneurysms by imitating the natural or spon-

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*Read before the Southern Minnesota Medical Association at Owatonna, August 3, 1899. Reprinted from "The St. Paul Medical Journal," October, 1899.

taneous cures. The medical treatment is by rest and various medicines, most prominent of which is potassium iodid. This reduces the force of the heart action, and as syphilis is a frequent cause of arterial degeneration, we may thus account for some cures reported from its use. Many other drugs have been used for the cure of aneurysm, among them we find veratrum, aconite, and digitalis. Langenbeck and Plagge recommend the use of hypodermics of ergotin. S. Solis Cohen used hydrated calcium chlorid in doses of a dram a day, and, combined with rest, noticed great improvement.

Well-chosen remedies form an important adjunct to operative treatment.

Of operative measures, ligation comes first, and we have Anel's method, or proximal ligation next the sac; Hunter's proximal ligation at a distance from the sac; Brasdor's distal ligation below the sac; Wardrop's ligation of branches of the artery below the sac. Joseph Ransohoff recommends the extirpation of aneurysms where it is possible. Syme, forty years ago, made the same operation in aneurysms of special arteries.

Compression, digital and instrumental, is frequently successful. Elastic compression in cases of aneurysm of the extremities has proved successful.

Flexion and galvanic puncture have given satisfaction in some cases. Injections of coagulating substances into the sac have proved dangerous, as has manipulation of the sac to dislodge clots, and should be applied only to special cases.

Macewen's operation of irritating the inside of the aneurysmal sac with a sharp needle to establish points of white thrombi has proved successful in some cases. Injection of solution of gelatin into the circulation is still in an experimental stage. Acupuncture and the introduction of foreign bodies into the sac are methods of last resort. J. B. Murphy's suggestion of following the vessel from the most accessible side of a traumatic aneurysm directly into the tumor has proved very successful, and was practised in two of the cases reported.

Surgical anastomosis of arteries will undoubtedly be a feature in the future progress in the treatment of aneurysm. Those desiring an extensive description of the subject with reference to special aneurysms should refer to the chapter in Park's Surgery by Duncan Eve.

A brief report of 8 cases operated upon in St. Mary's Hospital is appended herewith:

Case 1.—*Intra-orbital Aneurysm.*—B. M., male, aged forty-four, had been very intemperate; consulted me in March, 1898, concerning his left eye, which was much congested, with exophthalmos and impaired movements; the lids were also much congested. About six weeks previous he had heard a loud snap in his head, and since then he constantly heard a rushing, roaring noise. The congestion was noticed about ten days later.

The stethoscope gave an aneurysmal bruit on temple, but very distinct on eyeball, which pulsated with each heart-beat. A diagnosis of intra-orbital aneurysm was made, and the left common carotid artery was divided between two ligatures.

All the previous disagreeable symptoms subsided; healing of wound uneventful; case discharged in eight days.

Case 2.—*Popliteal Aneurysm.*—Male, aged sixteen. Admitted to hospital November 16, 1898. Three weeks previous had suffered from gunshot wound in leg. The bullet, a 22 caliber, entered the popliteal space of the right leg. From the knee down the right leg was congested, and ¾ inch greater in circumference than the left at the calf. Pain, numbness, prickling, and inability to bear weight; flexion and extension cause great pain.

A fullness of popliteal space upon examination disclosed a pulsating tumor the size of a lemon in its lower part.

The *x*-ray showed bullet in upper posterior part of tibia. Compression and elevation gave no improvement during three weeks.

The popliteal artery was then ligated just above the sac, which was opened and packed with gauze for eight days. The collateral circulation was very good, and the patient discharged cured January 17, 1899.

Case 3.—*Aortic Aneurysm.*—Male, aged twenty-six. Admitted to hospital April 28, 1899. He first noticed presence of abdominal tumor three years before. Tumor was freely movable and pulsating, with more or less dull pain; obstinate constipation. April 29th exploratory operation disclosed a sacculated aneurysm of the aorta just above its bifurcation, and extending onto the left iliac, the attachment at the neck extending about 2 inches, the tumor bulb the size of an orange and about 5 inches long, which gave apparent movability. Patient discharged May 23d unimproved.

Case 4.—*Aneurysm of the Brachial Artery.*—Male, aged eighteen. Admitted to hospital July 16, 1899. Seven years ago had the arm drawn violently over the head, and from that time noticed a small tumor in the axilla. Three weeks ago, from being violently handled, the tumor began to enlarge rapidly and was painful. There was no expansile pulsation, but the size of the tumor would vary from that of a small lemon to the size of a large orange. July 17th, open incision. Temporary ligation of the artery above the sac, with removal of the aneurysm, beneath which was a spicule of bone on the humerus, which was removed with a chisel. Collateral circulation good. The case was discharged July 30th.

Case 5.—*Aneurysm of the Anterior Tibial Artery.*—Male, aged forty. Admitted to hospital November 17th. Right leg had been cut 4 inches above ankle with an ax ten days previously.

The wound had been dressed with pressure bandage; later it had opened and bled freely; had also bled the day before admission. Operation disclosed traumatic aneurysm of anterior tibial, which required ligating above and below. Discharged cured in three weeks.

Case 6.—*Arteriovenous Aneurysm of Cavernous Sinus.*—Male, aged forty-two. Admitted to St. Mary's Hospital in 1890. Six months previous, in a runaway, he was thrown from a wagon, his head struck against a post, causing a basal fracture; unconsciousness and hemorrhage from ears and mouth followed. The immediate recovery was followed by paralysis of the third nerve on the right side, exophthalmos, congestion of veins of conjunctiva, pulsating angular vein, and pulsation of all the large veins about the upper lid. A distinct bruit was heard on the right side of the head with stethoscope. Ligation of the right common carotid with catgut. Patient discharged in ten days with great improvement of symptoms, but slight pulsation of carotid noticed above points of ligature. He returned in three weeks with more pulsation, although not so marked as before operation. The catgut had probably loosened in tying the second knot, and the lumen of the artery had reopened. The inner coat probably was not broken, but if silk or double ligature of catgut had been used, the accident would not have occurred.

Case 7.—*Cirsoid Aneurysm of Foot.*—Female, aged ten. Admitted to St. Mary's Hospital with cirsoid aneurysm of the foot involving all the toes and ball of foot. There was partial gangrene of second toe, and recently there had been several severe hemorrhages. Amputation was made through the metatarsal bones. Case discharged cured four weeks later.

Case 8.—*Aneurysm of the Internal Carotid.*—Female, aged twenty-three. Admitted to St. Mary's Hospital July 31, 1899. Tumor of the internal carotid, with pulsation and bruit; tumor presents in right pharynx, which is crowded to the midline. Externally presents beneath the ear and right side of the jaw; pressure causes tumor nearly to disappear. Atrophy of the right half of tongue from paralysis of the hypoglossal nerve. Has complained of pain and trouble with the right tonsil for six years, tonsil having been removed five years ago.

Operation performed August 2d. Ligation of the right common carotid. Patient discharged from hospital two weeks later.

VARICOSE VEINS OF THE LOWER EXTREMITY *

CHARLES H. MAYO

With the advent of aseptic surgery has come the revival of many operations which were performed a century or two ago, but had fallen into disrepute because of the high mortality or impaired results from septic conditions. Previous to Listerism, surgeons had a wholesome dread of the veins, as, indeed, they have today, but they now feel prepared to prevent, in a great measure, the pyemic conditions which caused the high mortality of the older operators in this class of surgery.

The superficial veins are placed beneath the skin between the two layers of superficial fascia, and are thus supported by the muscles on one side only, the skin readily yielding to their distention, while the deep veins which accompany the arterial system have the support of bone or muscle to inclose them alike on all sides, and these seldom become varicose.

Both sets of veins are provided with valves which are more numerous in those deeply situated. All the superficial veins of the lower extremity are connected with the internal and external saphenous veins. The long saphenous from the dorsum of the foot, where it anastomoses with the short saphenous, passes in front of the internal malleolus, then behind the inner border of the tibia, where it is in relation to the internal saphenous nerve. Its upward course lies behind the internal condyle of the femur, and joins the femoral vein one-half inch below Poupart's ligament. The internal saphenous has from 2 to 6 valves, and communicates

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* Read before the Minnesota State Medical Society at its Thirty-second Annual Meeting in Duluth, June 28, 1900. Reprinted from "The St. Paul Medical Journal," September, 1900.

with the deep veins in the thigh. The external saphenous vein, commencing at the dorsum of the foot, passes behind the external malleolus and extends upward by the outer side of the tendo Achillis in relation with the external saphenous nerve, and, passing to the back of the leg, joins the popliteal vein at the back of the knee, passing between the two heads of the gastrocnemius muscle. This vein has from 3 to 9 valves.

The venous coats are less liable to degenerative changes than those of the arteries. Fatty degeneration is rare, while calcification in dilated veins is somewhat more common. Amyloid degeneration rarely affects the superficial veins, but is found in the veins of such organs as are prone to amyloid degeneration. Cancer involves the veins much earlier than the arteries. The most common disease of the venous coats is adhesive phlebitis, which to a limited extent may occur in conditions of otherwise good health. It is accompanied by local pain, tenderness, and edema. There are no pyemic symptoms, because there is no sepsis. Adhesive phlebitis may resolve, but more commonly results in complete and permanent obliteration of the vein. If deep veins are affected, the superficial veins will be markedly increased before the edema appears.

When the superficial veins are affected, the hard cords or knots can be felt by the finger, the thickening due to phlebitis or periphlebitis. The term varix means excessive dilatation of a vein, and while more common to the veins of the rectum, spermatic cord, and lower extremity, may occur in any region.

Various writers have given classifications of varicose veins, the simplest of which is that given by Bennett: First, those which are congenital; second, those due to obstructed blood-current; third, those known as traumatic, which are caused by strain without thrombosis; fourth, those which result from thrombosis. Congenital cases are not usually noticed before the age of puberty, and may affect the superficial veins only, occurring in the calf, or they may connect with the deep veins of the popliteal space and have extensive development about the knee, or in some cases all the superficial veins of the lower extremity may be involved.

The pressure of a pregnant uterus develops one class of the second variety. If the valves do not give way or thrombus form, such cases improve after the relief of pressure. Strain may cause permanent varicosity by the injury to the valves.

Thrombosis is a frequent cause of permanent varix. Thrombus below the knee, while producing temporary disability, is not, as a rule, dangerous, as the irregular size, cystic dilatation, and acute bends prevent dislodgment. Thrombosis of the larger veins above the knee is more serious, as the dislodgment of clot occasionally occurs. Bennett has shown that the extension of a thrombus is checked by valves if perfect and also by the nearest collateral branch. A thrombus, while in some cases aggravating the varicose condition, may also prove of benefit in causing permanent obliteration of certain veins. Thrombus fragments, when dislodged so as to enter the deep circulation, pass to the heart, and if large enough, may cause sudden death by obstructing the pulmonary artery. More commonly a part of a lung or one whole lung is cut off from arterial circulation, and after a day or two of extreme shock, rapid respiration, and acute dilatation of the heart, these cases go on to recovery.

Trendelenburg believes that varicosity depends upon great control pressure, and that in many cases a venous circle exists in the veins at the thigh, by connection at the saphenous opening, and in the popliteal space, of superficial and deep veins, the intravenous pressure at times equaling the arterial. Such a condition, with the constant change in tension due to position, readily explains the passive congestion which is one of the causes of ulcer and eczema, thrombosis and injury forming a fair proportion of such troubles. The passive hyperemia results in exudation from the vessels, and the discolored areas in the skin are the result of previous local phlebitis in which blood-coloring has stained the pigment.

Scars in the upper half of the leg are commonly caused by syphilis, while those in the lower portion are probably varicose. In examining for other diseases, many cases of varicose veins are discovered which are in no way producing discomfort. Such cases should not necessarily be treated for the varicosity by operation or giving elastic supports. The symptoms of varix are the pain in the limbs from the long standing or use, cramps in the muscles, edema, and sometimes eczema or ulceration.

Varix of the leg following injury requires elastic support, and after all tenderness has disappeared, massage is useful. The elastic support is continued for several months, and in many cases a cure will result. Elastic support is seldom of benefit extending above the knee, except in the rare cases of extreme edema of the entire leg. The supporting treatment is used with benefit in many patients who do not lead active lives and are able to give time and attention to prevent an increase of the disease. Such treatment, combined with the use of a wash of bismuth, oxid of zinc, glycerin, and spirits of camphor, 1 dram of each to 4 ounces of water, followed by soothing ointments, will usually relieve itching of the eczemas which are of such frequent occurrence and the cause of so much suffering. Ulcers arising from the varix are often serious in their extent and difficult to heal, and in cases of long-standing degenerative changes sarcoma or epithelioma is occasionally met with.

There are many methods of curing ulcer, the essential features of which are cleansing and rest in bed, or support by bandage, combined with some harmless application. The sloughing ulcers, with edema and of foul odor, may be readily cleansed by applying one or two yeast poultices. Milder cases can be quickly cleansed and placed in an aseptic healing condition by the daily application of bovinin on gauze. Kohler grafts ulcers by the Thiersch method without removing granulations, but it is more satisfactory to excise the ulcer and remove the fibrous base, which, if left, later impairs the vitality of the graft, then a Thiersch or Wolf graft may be applied, with good prospect of success. Operations on ulcers should in most cases be combined with some operation upon the veins, although operative treatment for varix may be advisable often for pain, cramps, swelling, eczema, and phlebitis, when no ulcer is present.

Sanders treated 100 cases of varix with good results by applying the Cresby spring pad to a part of the long saphenous. The pin operation, as well as the treatment by ligature, is looked upon unfavorably by many, from the frequent infections. Stokes lost two cases by ligature, and he now applies two ligatures, dividing between. Others, by longer incision, remove sections of the veins, ligating all bleeding points. Trendelenburg removes a section of the long saphenous at the juncture of the lower and middle third of the thigh, when the vein is involved. Schede, under an Esmarch bandage, makes a circular cut around the middle of the leg down to the deep fascia, and sutures the wound without drainage, trusting to pressure and elevation to prevent bleeding. Excision of the long saphenous from the middle of the thigh to the ankle is often practised. In some cases a combination of two or three different methods may prove of advantage.

From an operative standpoint, Bennett divides these cases into two classes: (1) Those in which the defect is local. (2) Those in which the long saphenous is involved in the thigh as well as the leg. The local cases should be operated upon. In the second class we should operate when the saphenous vein is involved above the middle of the leg, and in those cases in which the superficial veins of the leg seem to communicate freely with the deep veins.

Operations on varix are often somewhat disappointing, as the cure is a relative one, an elastic support being required for an indefinite period, and other veins developing varix later.

Thrombus of the deep veins may occur, and the superficial veins become distended in maintaining collateral circulation. Such cases are apt to be edematous, and it is in the cases with edema that operative treatment becomes a serious question. Eisendrath reports an amputation of the leg for gangrene which he says followed shortly after a Schede operation for varix.

We first excised the entire long saphenous for extensive varix twelve years ago, and this operation is one of choice still. The Schede operation is followed by considerable edema and numbness of the skin from severing the cutaneous nerves. A partial or half Schede, or local excision of varix, combined with Trendelenburg, proves a very satisfactory operation. These cases require excessive asepsis in preparation and operation, as they are liable to erysipelas, while previous treatment of eczema or ulcers and a final preparation of shaving and cleansing should be made the morning of the operation. The ulcers should be grafted at the same time of the operation on the veins. The entire wound may be closed with a running catgut suture, and the dressings not disturbed for a week. The surgeon will give additional safety to the patient if rubber gloves are worn by himself and assistants.

During the past six years 53 cases were admitted to St. Mary's Hospital for treatment of varicose veins of the leg. Many of these patients received treatment on both legs. Nine cases were operated upon by the method of Schede, 8 by that of Trendelenburg, 6 by Trendelenburg and double ligation of veins at several places, 13 by ligation and turning large flaps, 17 by excision of the enlarged veins.

THE SURGICAL PHYSIOLOGY OF THE LYMPHATIC SYSTEM *

CHARLES H. MAYO

A careful study of the lymphatic system readily explains many physiologic as well as pathologic processes.

The great part played by the absorbents in maintaining the nutrition, repair, and defense of the system has apparently received little attention as compared with its importance. That the greater part of the absorption of the body, except intestinal, is accomplished by the lymphatics is well understood, but their direct relation to surgery seems to have been only occasionally appreciated.

The lymphatic system, consisting of vessels, channels, spaces, and glands, accompanies the arterial system, but varies greatly in extent and character, according to location. These vessels drain certain definite areas, and when diseased by infection, it is usually possible to locate the point of entrance. The lymphatic is a closed system, having capillaries ending in connective-tissue spaces, and the vessel-walls, while resembling veins, are exceedingly thin. When we consider that all the tissues of the body are more or less bathed with lymph, a fluid derived from and almost similar to the blood-plasma, we would expect to find, as is the case, that tissues will be supplied with lymph and absorbents in direct proportion to their exposure and necessity for repair, as well as to their activity. Interspersed in the course of the lymph-vessels are found groups of glands. These organs vary from the size of a pinhead to that of a large bean, and serve, from their structure, as filters to all the fluid passed through them. The glands are filled with

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* Reprinted from "Trans. Southern Surg. and Gyn. Assoc.," 1903.

nests of the forming leukocytes, and all the lymph is exposed to the probable purifying action of these cells. It is here that the great bulk of bacteria is checked in infection, and through the action of the leukocytes or some unknown physiologic chemistry only a limited number of bacteria and the toxins are permitted to pass to the venous system. It is here that the cancer-cell is checked, and later overpowers the gland and develops in its outer layers; so one gland after another takes up the work of protection by preventing the waste-cells, the products of metabolism, of nutrition, repair, or infection, from entering the blood unchanged. Leukocytosis, then, will depend largely upon the region involved in inflammation, as well as the intervening gland and lymph area between it and the circulation.

An enlarged gland is an evidence of a local struggle or of a defeat, and it is this type of gland tumor which is usually considered in surgery. In an examination of 88 animals and 3 men who had died of non-infectious diseases, Manfrid found infected glands in 78 of the animals and in all the men. The glands are grouped in the neck in large numbers, as about the mouth, nose, and trachea, and are so many possible points for the invasion of bacteria.

It is claimed that the glands are capable of reformation after removal, by development at the union of new lymphatic vessels, as the cells found and the reticulated structure and capsule are all capable of generation in these glandular regions. For this reason we must, if possible, destroy the original focus when glands are removed for infection. In certain cases where the glands and lymphatic area are so thoroughly removed that the return of the lymph to the circulation is nearly abolished, a peculiar condition of lymphedema of the limb develops and remains until the equilibrium of the circulation is reëstablished. This is noticed not infrequently in cases of operation for cancer of the breast, where the arm may remain in such a condition for a considerable period. For a long time it was thought that there were but the two lymph-ducts of entrance into the circulation. The right lymphatic duct opening into the right subclavian vein receives absorbents from the upper right half of the chest and thorax, also the right upper extremity and side of the neck and head. The left or thoracic duct empties into the commencement of the left innominate vein and drains, or has been supposed to drain, all the rest of the body. Leaf has recently found that there may be a communication between the lymphatics and small veins in the groin, and it is possible that others exist and will eventually be located. The nutrition of the body is maintained by absorption of water and digested food, nearly all of which is taken directly into the circulation of the intestine after passing the epithelial cell. By some wonderful chemistry this cell prepares this material into a suitable condition for association with the blood. The fats are unable to pass the barrier, and, with the products of metabolism, in maintaining the chemistry of the absorbing cells, enter the circulation by way of the chyle-ducts.

It is now generally considered that the ductless glands are drained by the lymphatics. When we think of the great importance and the intense and sudden effects of these glands when given to the system, we can see the benefits of an intricate duct system, while the failure to drain certain alveoli may partially explain the development of peculiar types of retention cysts, as in colloid cystic goiter. The hard, dry gland often found in exophthalmic goiter and the extreme symptoms of Graves' disease, many of which may be produced by thyroid feeding, may possibly be in part due to an excess of drainage.

The lymph fluid, being of nearly the same density as the blood, no great osmotic action into the circulation can be expected, although the ready absorption of solutions injected into the tissues is explained by direct endosmosis as well as by lymphatic absorption. The quantity of lymph depends upon the pressure in the capillaries and the permeability of their walls, while its circulation depends upon muscular action, respiration, and the heart.

The causes of inflammation are thermal, mechanical, or toxic or toxic irritations, the last including the chemical changes caused by bacteria. Some authors would limit the term inflammation to the infected cases only, calling the changes incident to other forms of irritative reparative processes. From one or more of these agents acting through the local nerve-supply there occurs a dilatation of the local arteries, veins, and capillaries, followed by an increased rapidity of the circulation, which soon slows, and the white cells adhere to the endothelial layer and pass between these cells, to become the leukocytes in the surrounding tissue. With increased irritation the plasma exudes still more, there is a free escape of blood-cells and fibrin, and the exudate is now capable of coagulation. Exudates are known, from their quality, as serous, fibrinous, croupous, diphtheric, hemorrhagic, or suppurative. Serous exudates follow irritation, and occur also in passive congestion and venous stasis, as represented by forms of eczema, anasarca of advanced cardiac or renal disease, and the ascites of obstructed portal circulation. The exuded fluids may become inoculated with bacteria in open wounds, or bacteria may make an exudate from the irritating power of the toxins and the peptonizing power of the bacteria. This fluid is known as pus, and consists of the plasma with white corpuscles and the fixed tissue-cells converted into pus-cells, with the bacteria peculiar to the infection. In fresh wounds there is an escape of a bloody, serous, albuminous fluid from the divided tissues, lymph-spaces, and capillaries. This fluid distends the tissues and separates the injured surfaces, preventing or delaying healing, and, being highly albuminous, is subject to infection and decomposition. It is to relieve the tissues of these fluids that external drainage is established. The result of considering drainage as being the delivery in all cases of exudates to the surface is the probable explanation of why each operator has developed a system from his own experience with reference to this subject. The changes found in special organs are most marked. The brain, in which we would not expect much cell change or repair, is filled with lymph-spaces, but is very deficient in lymphatics, the subarachnoid space serving as the absorbing area on its surface. In its substance often we will have a hemorrhagic exudate remain as a local collection; then, by means of secondary changes of the blood-cells and a deposit of fibrin and albumin, a surrounding wall is developed, and the exudate is now a cyst, the change requiring a few weeks to months. Injuries of the skull and brain develop cystoid scars as a result of adhesion of the membranes and shutting off of the arachnoid space, while inflammatory diseases, unless involving the surface, may cause no change in temperature, and like cysts will be located principally by pressure symptoms. It is well known that abscesses may remain for long periods in the substance of the brain without marked symptoms.

The liver and kidney are peculiar gland structures in which the excretory ducts can, to a certain extent, supply the place of lymphatics in ridding the organ of the products of metabolism. In these organs there is a deficient lymph circulation in their structure, yet a free one upon their surface and at the region of blood-supply. The symptoms of inflammation will be somewhat like those in the brain, yet less marked. Inflammation near the surface causes marked disturbances, especially should perforation of the capsule occur and a greater field for absorption be invaded. The skin is filled with lymph-vessels, constant repair and protection being necessary.

The lungs are rich in lymphatics, and infections or toxins are early and constantly delivered into the circulation, with the resulting reaction of fever. The onset of infections in regions rich in absorbents, as the lung, neck, axilla, or groin, is often marked by a chill, to be followed by continued temperature during the infection until reaction develops protective granulation. Repeated chills occur when accumulated products of infection are delivered at intervals into the venous circulation without the intervention of the lymph-system, as in sinuses of the brain, liver, bone-marrow, uterus, or prostate, and occur in streptococcus poisoning, where the edema and induration may cause veins to open as sinuses, or when local foci of infection occur in the circulatory system itself.

The peritoneum is little less in area than the entire skin-covering of the body. Its lymphatic system is most active in the upper portion of the abdomen. The lymph-vessels of the peritoneum over the small intestine are numerous, while there are few in that portion covering the large intestine which are capable of but little absorption, as is the parietal or pelvic layer. The peritoneum covering the colon is, then, exudative, and over the small intestine absorptive, not considering the lacteals of the mucous membrane.

The fundus of all organs is deficient in lymphatics, hence acute obstruction gives cyst formation, and chronic inflammation causes shrinking and thickening of the organ. Against infection, the body has a certain degree of resistance in the blood; fresh blood is germicidal to some extent, later is also a culture-medium from the contained albumin. It is increasingly germicidal at a temperature of from 100° to as high as 104° F., rapidly losing it thereafter with increasing heat. The plasma free from albumin is more strongly germicidal than the blood. There is a continuous absorption of all exudates in regions supplied with lymphatics, and in infectious diseases due to a carrying to the circulation of toxins and at times bacteria, and, as a result of increased tissue metabolism, there is temperature. From repeated infections the system may become nearly or quite immune to reactionary disturbances, and local infections long retained lose their virulence through a type of continuous inoculation by absorption in minute doses and through the death or loss of virulence of the bacteria.

If this view of the action of the lymphatic system is correct in outline, it affords additional light upon some obscure pathologic conditions. Certain organs are subject to cysts, and the same ones, also, to sclerosis; we find that they are the organs with a deficient absorbent system. In theory, then, a chronic excess of diffusion would be followed by connective tissue due to the chronic irritation. This would be most marked in the proximity of the vessel. Acute hemorrhage may not be absorbed, and by natural changes it may produce cysts.

Considered in this relation to malignant disease, the condition of the lymphatic system is of the utmost importance. In fact, practically all the advancement of modern surgery of cancer has been through a study of the areas of lymph distribution involved in any malignant focus. We now have definite gland fascia areas which must be removed with, or at the time of, the removal of the original malignant growth. This is true of internal as well as of external deposits. It is usually said of cancer that early operation gives a good prospect of cure. This may be modified by the conditions of age or lymph circulation in the area involved. Thus cancer in the young is rapidly fatal, and early recurrence or metastasis frequently follows operation, the gland distribution being early involved. As compared with the young, old age with its disappearing lymph-system and late operation, rather than early, time alone considered, may often be more favorable for permanent recovery.

Cancer statistics as to cure improve with each decade of life, other conditions being equal.

Varieties of Drains and Drainage Adjuncts

First: Rest by splints, pressure dressing, or bed, to quiet the circulation. Second: Elevation to reduce arterial supply and favor venous and lymphatic return. Third: Massage to break up coagulated exudates and enable the lymph-vessels to remove the exuded material. A good masseur, for instance, will relieve the ecchymosis and swelling of a black eye in a remarkably short time by alternate massage and rest. Fourth: Moist dressings favor escape of exudate from open wounds and also favor the lymphatic circulation in closed injuries. Fifth: Adjuncts to drainage in the use of solutions having affinity for moisture acting by osmosis, as glycerin or alcohol. Sixth: Wound drainage is accomplished by the open method, with or without secondary suture. Seventh: Separate incision. Eighth: Wicks, capillary or tubular drains, or gauze packs as mechanical aids.

Capillary drains are of catgut, hair, or silkworm-gut in bundles, and serve to drain serum of small amounts in small wounds, or in large wounds where prolonged aseptic drainage is required, as after gland removal. Capillary drainage is not sufficiently free for the drainage of pus. Tubular drains deliver freely all wound secretions, and in aseptic cases should serve their purpose in from twenty-four to forty-eight hours. When of rubber, they should be split from end to end instead of perforated, as it is more flexible, with less danger from pressure, drains at all its length, and is easily removed. By means of a thread attached to the tube it may be removed without removal of the dressing. In septic cases the tubular drain should be left until the wound is lined with granulation tissue and is without pockets or accessory cavities, as granulation tissue is the natural protection of the system against absorption, as well as being a reparative process. To drain the general peritoneum freely, nothing seems better than glass, as lymph adhesions form slowly about its surface; thus a large area is brought under its influence. Gauze is peculiar in its action, at first being a capillary drain; later its meshes become choked with fibrin, and it no longer has capillarity, therefore it should not tightly fill the opening from which it emerges. It is a great developer of granulation, as it strains out the blood-cells and fibrin from the serum, thus holding in apposition to the cut tissues elements necessary to the development of granulation. Tube drains carry away the same material, and granulation will be slower. It is this peculiar action of gauze which makes it necessary to leave it without disturbance for at least four to six days. Earlier meddling will tear open the young granulations, give fresh injury, open lymph-spaces, and in clean or septic cases it is usually a cause of temperature. Gauze is used in draining acute injury of the brain and in the quarantining of acute infections of the peritoneum. Aseptic operations are frequently followed by 1 to 3 degrees rise in temperature within from twenty-four to thirty-six hours, which is caused by absorption of blood and is a ferment fever. Temporary fever later than this may be from the intestines, but if this temperature continues, the wound should be examined, as it is probable that there is some disturbance in the healing process.

We may say, then, that aseptic operations in regions rich in lymphatics, where the lymph circulation is but little disturbed, will not require drainage—as ligation of vessels in the neck, Alexander's operation, and hernias in the inguinal region. We may also say that aseptic operations in those regions in which the lymph-system is removed require capillary drainage from four to six days, as autodrainage is temporarily abolished and early removal results in serous accumulations without temperature, discovered usually when the cases should be dismissed from care, as in removal of cervical glands, cancer of the breast and axillary glands, and malignant disease of testicle and inguinal glands.

Free drainage of the stump should be employed in amputation for malignant disease where the glands are removed from axillary or inguinal region.

In regions rich in lymphatics, where operations for septic conditions must necessarily be made, we open fresh areas for absorption of toxins, and our endeavor should be to use upon the incised surface strong antiseptics, such as carbolic acid, followed by alcohol, chlorid of lime as a caustic, or in mild cases glycerin, to prevent or inhibit the action of the absorbents and maintain the disease as a local infection. This is markedly shown in operations for the removal of bone necrosis. For the same reason the cautery is used to incise abscesses in certain regions, and also to make puncture drains of cellular streptococcus poisoning.

Iridectomy and scleropuncture in glaucoma substitute one set of lymphatics for another. In operating for the relief of increasing spina bifida a suture of two strands of silkworm-gut or catgut can be passed through the stump of the sac, temporarily to deliver the spinal fluid into the tissues of the back. Experimental work is now being conducted with a view permanently to drain forms of hydrocephalus into the rich lymph-system of the cervical region. In the drainage of wounds it is a good rule to make a separate incision at the most favorable point and close the original operative wound completely. This plan will improve the scar, and in large abdominal incisions will very often avoid hernia.

In aseptic operations of the abdomen involving considerable bruising or denuding of the peritoneum the pelvis should be elevated by raising the foot of the bed, the gravity acting as an aid to autodrainage, the peritoneum being capable of absorbing from 3 to 8 per cent. of the body weight in an hour.

In septic diseases just the opposite condition is desired, to secure drainage and maintain the condition as a local one, by elevating the head of the bed and also elevating the upper extremity of the patient to gravitate to the pelvis, where delivery may be made through glass tubes. This method is used in diffuse peritonitis. The diseased or septic focus should also be quarantined by a gauze pack through a separate incision should the condition of the patient warrant the increased operative interference.

THE SURGICAL TREATMENT OF VARICOSE VEINS *

CHARLES H. MAYO

In considering varicosity of the veins of the leg, without doubt the essential predisposing cause is a congenital defect in the vessels or their enervation. While some individuals with such a tendency develop no serious condition, others aggravate their condition by occupation, injury, child-bearing, or constipation.

The symptoms caused by varicose veins may be fullness or a sensation of fullness of the leg, edema, pain from nerve irritation increasing in severity with use, distention of the veins, with at times a venous circulation in the internal saphenous from the saphenous opening to the popliteal vessels. Pruritus occurs often with or without eczema, also pigmentation and discoloration of the skin and varicose ulcers. Some aggravated cases suffer from all these symptoms, some with one or two, others with greatly distended veins complain not at all.

Clinically, then, these cases come to the physician to have a diagnosis confirmed and obtain relief, or they come complaining of one or more of the various symptoms produced by the disturbed venous return. According to the severity of the case, it is treated hygienically or mechanically by supports and massage, possibly aided by various lotions, or surgically by one of the various methods elected by the physician in charge.

The older methods of treatment by pressure, pin-ligation, and the like, we pass over as merely a bit of interesting history of surgical progress. Of the methods in use today, probably the Tren-

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*Read at the Thirty-sixth Annual Meeting of the Minnesota State Medical Association, June 2, 1904. Reprinted from "The St. Paul Medical Journal," September, 1904.

delenburg operation or ligation and section of the internal saphenous in the upper third of the thigh, and the Schede circumcision operation in the leg, are the most popular. Multiple open ligation and the excision of the veins are also common operations. The Trendelenburg operation is simple of performance and checks the superficial venous return at a high point. The intercommunication of the superficial with the deep veins and the external saphenous veins in the popliteal region at least delays and at times prevents, recovery. The benefits, therefore, from this method alone are slowly manifested, yet in time marked relief is afforded. The Schede operation of circumcision of the leg through all the superficial structures to the muscles, with ligation of the large veins and coaptation of the skin, impedes all the circulation below the incision, but many of the patients complain nearly or quite as much of the numbness from section of the cutaneous nerves and slight edema following, as they did of their previous condition. There is also some danger from gangrene of the foot. If the venous circle of the thigh existed, it was, of course, but little benefited, and either required ligation or excision above the knee, yet in most cases the ultimate results were good or fair. Excision of the veins was an operation which gave good results, but was slow of performance and opened a large cutaneous area for increased possibilities of infection. The region of the knee from flexion often developed a form of keloid or scar eczema. Operations upon the veins below the knee by local incisions and ligations give benefit at least for a time, but do not control sufficient area, as a rule, unless made more extensive than is apparently warranted by the condition.

We have operated upon 125 cases of varicose veins, many times operating upon both limbs. The complete Schede operation we have not made for several years, but a partial Schede or oval incision above a large ulcer is frequently made, combined with excision of the ulcer and skin-grafting; at the same time the Trendelenburg operation, or the more extensive excision of the internal saphenous vein from the upper third of the thigh to a point 6 or 8 inches below the knee, is performed. The removal of short areas of veins is reserved for those cases with involvement of the veins of the posterior thigh of the external saphenous. We have always been partial to the excision of the long saphenous for the majority of cases. The earlier operations were by a long incision over the vein. It required considerable time to close the wound, and seemed to be quite a serious operative procedure, especially in the time involved to accomplish what should apparently be the trivial removal of superficial veins. This we partially overcame some years ago by a long incision both in the thigh and in the leg, leaving 5 to 6 inches of skin intact at the side of the knee. The vein was separated above and below, and under slight tension a pair of forceps was employed to enucleate and loosen the vein in the uncut area. Gradually the method of subcutaneous enucleation was increased until the whole vein was removed by means of 3 to 5 incisions of one inch in length. More recently we advised a ring vein enucleator, which consists of a ¼ inch ring of steel with a long handle, the whole instrument being not unlike a blunt uterine curet, which would possibly serve the purpose with the ring bent at a more acute angle. We have also had made a pair of long heavy forceps which are hollowed out in each blade so as to form a long tube when closed about ¼ inch in diameter. The vein is sought for and severed in the upper third of the thigh. The proximal end ligated, the lower end is clamped an inch from the end, which is passed through the ring of the enucleator or placed in the tube of the forceps, and the clamps are transferred to the end of the vein. By a gentle pushing force the ring or forceps is pushed down the vein held under tension for 6 or 8 inches, tearing off the lateral branches, when the point of the instrument is forced against the skin from beneath, and a small incision made in the skin to the ring or forceps, which is pushed through the opening, holding the vein in it like a thread in a needle-eye. The vein loop is drawn out of the opening and also from the instrument, which is removed and rethreaded on the vein, and again forced through the new skin opening, following the vein, and is pushed down to a lower point, where the small incision is again made and the same process of removal repeated. The small lateral branches are torn off and, as a rule, have enough muscle structure to close themselves. Below the knee the branches are larger and the vein is more adherent, being more superficial, so that a short distance can be traversed. Hemorrhage is avoided first by position. An ordinary gynecologic standard is placed in position, and the leg raised in straight or extended position and supported by the ankle. This position renders the limb partially bloodless, as well as secures elevation and accessibility of the field of operation. Should any branches cause more than momentary hemorrhage, they can be checked by a small pack, which is left for a few minutes in the incision from which it arises, or an assistant can usually instantly check hemorrhage by a pressure pad held against the skin, over the region from which the blood escapes from the vessels.

In a very few cases where the veins are enormously and irregularly dilated the stripping process is impossible through the whole extent of the saphenous. The Bristol method is then used, of torsion removal of the veins by forceps through open incisions, as an adjunct to the enucleation treatment.

Should there be a persistent eczema after a week's preparation previous to the operation, it is proceeded with as usual, the ulcer being excised before enucleation of the vein. The ulcerated area is skin-grafted. The eczematous area is now painted with compound tincture of benzoin, which acts as an aseptic varnish, literally sealing the surface until the incisions have themselves become sealed against infection, serving a purpose for a longer period, yet acting somewhat like Murphy's rubber dam for abdominal operations. The dressing is applied and the patients placed in bed with the leg somewhat elevated by two pillows. In twelve days they are allowed to get up, wearing an elastic porous bandage for a few months for a support.

The method outlined has reduced the time for operation very considerably, and has placed it in the class of relatively trivial operations, although sepsis may render it one of the most serious.

TREATMENT OF VARICOSE VEINS *

CHARLES H. MAYO

There are many operations in use at the present time for the relief of varicose veins. The disease is one that manifests such diverse conditions and symptoms that no one method can be suited to all cases.

While the superficial veins are usually considered as producing the symptoms, it is probable that the deep veins, from the thinness of their walls, are often involved.

The veins usually affected, with their various tributaries, are the long or internal and the short or external sapheni. The internal extends from the saphenous opening in the upper part of the thigh down the inner side of the leg to the ankle, where, through the dorsal vein of the foot, it connects with the external saphenous vein, which extends from the external malleolus to the popliteal space, where it penetrates to the deep veins. The two sapheni communicate at the knee; here, also, the internal communicates with the deep veins. The external occasionally extends higher, joining the veins of the outer and back part of the thigh. There are a number of valves in the large veins to aid in the support of the blood-column. The internal saphenous nerve accompanies the vein from below the knee down; the external nerve is in relation with the external vein in the lower part of its course.

In most cases it is difficult to attribute any cause for varicose veins. The most probable etiologic condition is that a congenital defect exists in the vein-walls or valves—in fact, it is a considerable question whether normal veins give way under the ordinary strain of life. A large number of those affected have dilated or

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* Read before the meeting of the Western Surgical and Gynecological Association, 1906. Reprinted from "Surgery, Gynecology, and Obstetrics," April, 1906.

enlarged veins at from twelve to twenty-five years of age, although many years may pass before any serious consequences arise, and others do not suffer from any disabling symptoms during a long lifetime. Vocation may often increase the condition and symptoms. Some patients attribute pregnancy as the cause; others, the pressure of tumors, phlebitis, or injury. There is also a type of the disease with multiple areas of dilatation of the fine veins, like small nevi.

The common symptoms are: a sensation of fullness or weight of the leg, edema from standing positions, and pain from nerve irritation. The discomfort increases in severity with the use of the limb. Distention of the veins is usual, and in many cases there is a venous circulation in the thigh, unchecked by valves, and continuous with that in the deep vessels. More or less annoying pruritus is usually present, and is often accompanied with eczema. Pigmentation and discoloration of the skin from local hemorrhages are frequent, while one or more ulcers may increase the discomforts of the sufferer.

Many patients come for relief knowing their trouble and its cause; others describe symptoms resembling those of sciatica or even flat-foot, and it is possible that there may be some relation between the disease and late-appearing flat-foot.

The so-called Trendelenburg phenomenon is tested as follows: The leg is elevated with the patient lying down, and when the veins are empty, the long saphenous is compressed at its upper portion; the patient now stands erect, the pressure is removed, and if the vein fills from below up, the valves are intact; if the wave of blood descends, the valves are useless, and the veins sustain the venous gravity blood-pressure from the heart down, and for such the Trendelenburg operation is indicated.

In a few cases it is possible to obtain sufficient relief by a change in vocation or climate. The more common method is wearing, during the day, elastic supports, such as bandages or stockings. Leander's truss for the same purpose is worn to produce pressure on the saphenous in its upper portion.

Operative measures for relief are as old as the history of surgery. Most of the known methods still have their advocates, and as they represent various principles in surgery, we mention several of them.

Ignipuncture with Paquelin or electrocautery, which is still employed; cutaneous suture and subcutaneous ligation of Velpeau and Delpech, which is now seldom used; injections of irritants into and about the veins, as Paul Vogt's injections of ergotin about the veins; Durante's method, which is that of passing catgut soaked in Piazza's fluid of sodium and ferric chlorid into the vein through a cannula; the resection of a portion, or the entire length, of the veins involved; Casati's operation, by multiple ligation and excisions; multiple incisions with torsion removal (Bristol method); longitudinal incisions with immediate closure (Ledderhose); circular incisions of Schede and Peterson. Probably the most popular operation is that of Trendelenburg, who ligates and removes a short section from the upper portion of the long saphenous. The more recent methods are subcutaneous removal in suitable cases and nerve-stretching.

As a rule, thrombosed areas, while inflamed, have been treated by posture and local applications, although Kramer recommends their excision. In deciding the advisability of operation in cases which give a previous history of severe phlebitis involving the deep vessels, we apply an elastic bandage from the foot to above the knee. If this bandage can be worn with comfort, an operation should give relief. If the bandage causes discomfort, it is probable that the superficial vessels are necessary to the circulation of the limb.

In considering the indications for operation there is less benefit to be expected from any type of operation made below the knee, if the vicious venous circulation of the thigh exists, while the Trendelenburg method could hardly be expected to cure cases of disease of the external saphenous, or even the lower internal saphenous, where there are large channels of communication with the deep or external vein.

We have operated upon 185 cases of varicose veins, many times operating upon both limbs. The complete Schede operation we

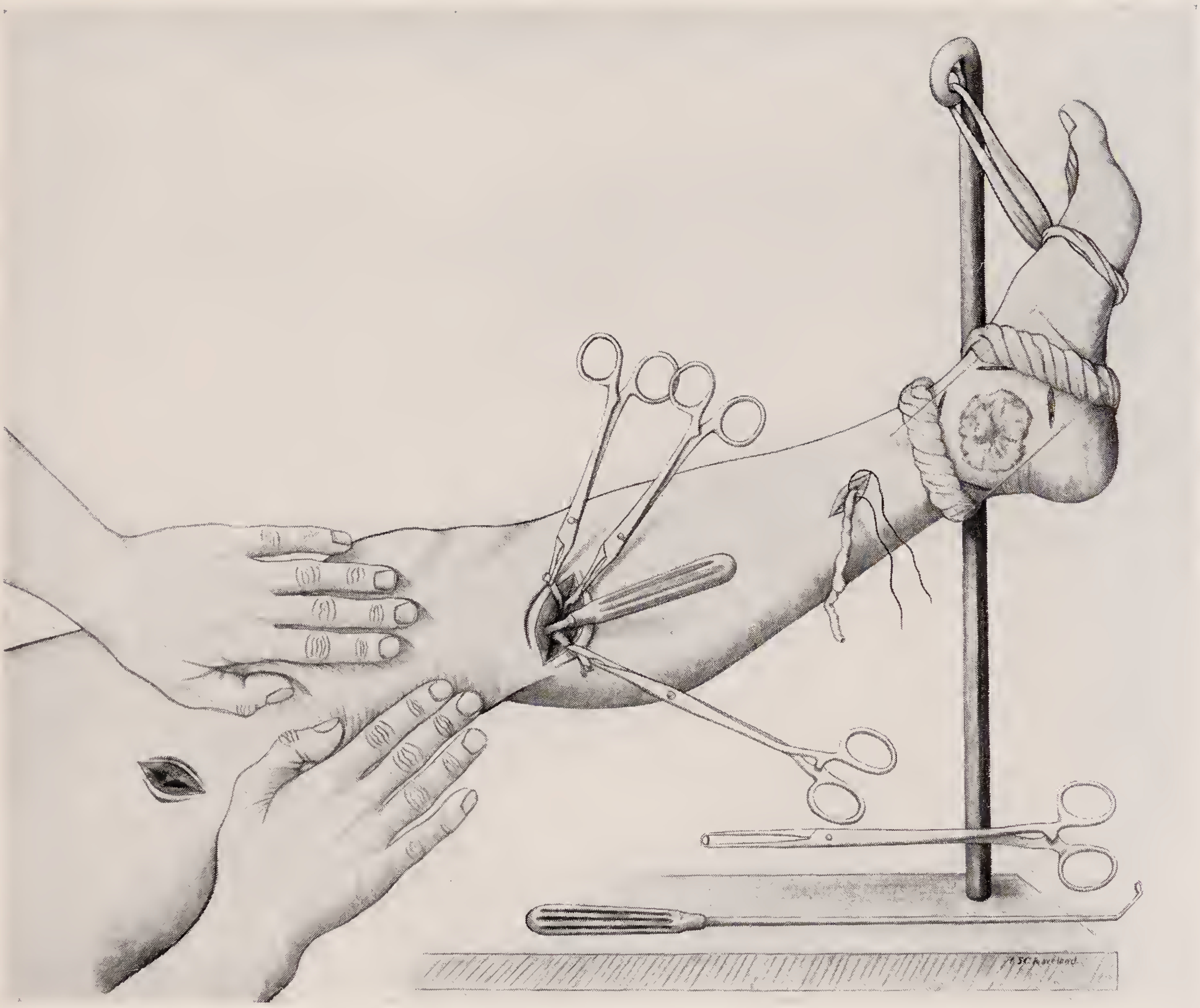

Fig. 71.—Representing the technic of the operative procedures.

have not made for several years, but a partial Schede or oval or interrupted incision above or about a large ulcer is frequently made, combined with the excision of the ulcer and skin-grafting; at the same time the Trendelenburg operation, or the more extensive excision of the internal saphenous vein from the upper third of the thigh to a point 6 or 8 inches below the knee, is also performed. The removal of short venous areas is reserved for those cases of involvement of the veins of the posterior thigh or the external saphenous. We have always been partial to the excision of the long saphenous for the majority of cases. The earlier operations were by a long incision of the vein. It required a considerable time to close the wound, and seemed to be quite a serious operative procedure, especially in the time involved to accomplish what should apparently be the trivial removal of superficial veins. This we partially overcame some years ago by long incisions, both in the thigh and in the leg, leaving 5 or 6 inches of skin intact at the side of the knee. The vein was separated above and below, and under slight tension a pair of forceps was employed to enucleate and loosen the vein in the uncut area. Gradually the method of subcutaneous enucleation was increased until the whole vein was removed by means of 3 to 5 incisions of 1 inch in length. More recently we have devised a ring vein-enucleator, which consists of a ¼ ring of steel with a long handle, the whole instrument being not unlike a blunt uterine curet bent to an angle near its tip. We have also had made for the same purpose a pair of long forceps, which form a ring at the end when closed.

The vein is sought and severed in the upper third of the thigh. The proximal end is ligated, the lower end is passed through the ring of the enucleator or placed in the ring of the forceps, and clamps are placed on the end of the vein. By a gentle pushing force, the vein being held to make tension and the tissues steadied on either side by an assistant, the ring or forceps is pushed down the vessel for 6 or 8 inches, tearing off the lateral branches, when the point of the instrument is forced against the skin from beneath, and a small incision is made to the ring or forceps, which is pushed through the opening, holding the vein like a thread in a needle's eye. The vein-loop is drawn out of the opening and also from the instrument, which is removed, rethreaded on the vein, and again forced through the new opening, following the vein, and is pushed down to a lower point, where the small incision is again made and the process of removal repeated. The small lateral branches are torn off, and, as a rule, have enough muscle structure to close themselves. Should the main venous trunk break, a new incision is made below the knee, the vein exposed and divided, and the enucleation made in both directions from this point. Below the knee the branches are larger and the vein is more adherent, being more superficial, so that a shorter distance must be traversed.

If it is found that calcareous deposits, sacculations, or extreme weakness of the walls render the case unsuited to the enucleation method,—and this occurs in about 10 per cent. of the cases,—the principle of operation should then be changed to an open method, undermining only the section by the knee.

Hemorrhage is avoided, first, by position. An ordinary gynecologic standard is placed in position, and the leg raised in straight or extended position and supported by the ankle. The position renders the limb partially bloodless, and also secures elevation and accessibility of the field of operation. Should any branches cause more than ordinary hemorrhage, it can be checked by a pressure-pad held against the skin over the region from which the veins were removed, or by small packs, which are left for a few minutes in the incision from which it arises.

We have tried the inversion of the veins,—Kellar method,—but found that ordinary forceps would subcutaneously loosen and torsion out short lengths without much difficulty.

When necessary to skin-graft an excised ulcer, we apply a twisted roll of gauze about the leg above and below the grafted area, to support a sheet of sterile celluloid or wire gauze held in place by a strip of adhesive. The final bandage is applied from the foot to the body, and a small area is cut out over the protective. This serves as a window through which to watch the condition of the graft, which usually unites with one dressing.

In our experience the subcutaneous removal of that portion of the internal saphenous vein extending from 8 inches above the knee to 4 inches below accomplishes by one method all that it is possible to gain by either the Trendelenburg or Schede in interrupting the main channel of superficial circulation and also checking communication with the deep circulation in this region.

Should there be a persistent eczema in spite of previous preparation, the operation is proceeded with as usual, the ulcer being excised before enucleation of the vein. The ulcerated area is skin-grafted. The eczematous area is now painted with compound tincture of benzoin or an acetone solution of gutta-percha, after Murphy's plan, which acts as an aseptic varnish, literally sealing this surface until the incisions have themselves become sealed against infection. The dressing is applied, and the leg is maintained in a somewhat elevated position for twelve days. The patient is then allowed to get up, wearing an elastic porous supporting bandage for a few months.

The method outlined has reduced the time for operation very considerably, and has placed it in the class of relatively trivial operations, when uncomplicated by sepsis or embolism.

As to the cures from the various methods, Goerlich reports, from 42 operators, 1425 cases, with from 65 to 85 per cent. of cures from the ligation of the internal saphenous. In this report, following the Trendelenburg operation (1 to 11 years) there were 51 cases, representing 69 operations examined, with the result that 84 per cent. were satisfactory and 16 per cent. failures. The report by letter from 29 patients, representing 39 operations, gave 70 per cent. satisfactory, 30 per cent. failures, or worse. The Trendelenburg phenomena recurred in 42 cases after excision of a piece of saphenous.

The first, probably, is a fair statement of the cures resulting from one method or a combination of methods, but the percentage of failures is somewhat high, as some are much improved, though not well. The causes of recurrence were from a widening of the collateral veins, formation of new veins, and, it is claimed, from regeneration of the saphenous itself. It is probable, in the latter cases, that the more superficial and smaller vein often noticed in the same region has been removed or has dilated and practically formed a new saphenous. The dangers are from pulmonary embolism, which Goerlich reports as recurring twice in 108 cases in von Bruns' clinic. Sepsis is rare, although a serious possibility, and difficult to guard against in some cases with ulcer and eczema.

HEAD

MASTOID ABSCESS—OPENING MASTOID CELLS *

WILLIAM J. MAYO

S., male, aged thirty-three. Occupation, drayman.

After exposure to a cold wind on September 15, 1886, was seized with pain in the right ear, for which he consulted me September 18th. Upon examination I found the external auditory canal swollen and tender in its upper and posterior walls. The ear-drum was pasty in appearance, and on account of the condition of the auditory canal, the examination was painful.

Fearing a repetition of the pain the patient did not call upon me again until four days later. I was then called to the house, and found him suffering from pain, fever, chills, and sweats. The condition of the parts behind the ear was obscured by the vesication of a blister I had prescribed when the patient was first seen. Placing my patient in a good light, I incised the right ear-drum freely and a drop of pus appeared in the wound. On the first and second days his condition appeared better. On the third there was a return of the fever, chills, and sweats, and I decided to open the mastoid cells. Chloroform was administered, the mastoid process freely exposed by incision, and a small quantity of fetid pus found beneath the periosteum. The temporal bone for some distance was rough, and the periosteum dissected up by this pus. With an ordinary gimlet I opened the mastoid process to a depth of ¾ inch. The relief was immediate and improvement marked. On the fifth day the opening in the process was enlarged with the dental engine, which was done rapidly and perfectly. Introducing a small, stiff drainage-tube and washing the cavity in the mastoid twice daily, much bone débris was removed, a peculiar feature being the pulsation of the fluid or pus in the tube. The improvement was gradual for about a week, when signs of septic poisoning appeared, and the patient rapidly succumbed on the fifteenth day after the operation.

* Reprinted from "Northwestern Lancet," November 15, 1886.

SURGICAL TREATMENT OF SUPPURATIVE DISEASES OF NASAL SINUSES *

CHARLES H. MAYO

The difficulties attending the successful treatment of suppurative diseases involving the nasal accessory sinuses have led me to present this brief paper, and while it contains no new features, a free discussion of this perplexing subject may prove interesting and profitable. The condition is such that self-diagnosis is not made, and the physician too frequently slights his examination, calls it catarrh, orders some nose-wash or spray, and tells his patient to adhere faithfully to prescribed remedies, as catarrhal troubles are not cured in a short time. In this way valuable time is lost and the disease progresses. The case passes by the period when simple means might have effected a cure. The mucous membrane becomes altered into a chronic, pus-producing surface, and in many cases the neighboring cavities are invaded.

We should all be able to distinguish pus from simple catarrhal discharge, and when pus is present, we should be sufficiently familiar with the nasal cavities to make a diagnosis of its probable cause, if only by exclusion, as the diseases characterized by purulent discharge are limited. Acute purulent discharges, such as occur in diphtheria or acute purulent rhinitis, present little difficulty in diagnosis. Chronic discharge of pus here probably means syphilis, foreign body, neoplasm, rhinolith, or abscess of an accessory sinus.

The antrum of Highmore, from its location, is most liable to disease, and when diseased, is least able to care for itself because of the unfavorable point of drainage. We can readily see how

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* Read before the Minnesota State Medical Society, June 17, 1891. Reprinted from the "Northwestern Lancet," August 1, 1891.

an abscess may be developed in this cavity from its nasal side, not by extension of catarrh, but by the results of catarrhal process or of syphilis producing caries or necrosis of intervening bony partitions or of the turbinated bones in the region of the natural opening, also in cases where we have a loss of the middle turbinate, allowing putrid secretions to drain into this then unprotected cavity.

From the oral side, a common cause is the extension of alveolar abscess, while a limited number are caused by extensive caries involving the lacrimal passage. Our choice of operation will depend to a great extent on the original cause. I have operated upon 5 cases of abscess of the maxillary sinus, representing 4 varieties of causation.

The first, a case of simple empyema produced by polypi obstructing the normal opening of this cavity, was cured by removal of the tumors, enlarging the nasal opening, and establishing through-and-through drainage into the mouth.

The second, due to extension of alveolar abscess, was cured by drainage through the cavity of the first molar.

The third case was one due to syphilitic caries, with loss of the middle turbinate bone on one side, exposing the normal opening. This patient was placed under specific treatment; the normal opening was enlarged by removal of carious bone, and the patient instructed in the use of a curved-nozle syringe for cleansing purposes.

The fourth was one of long standing, the result of alveolar abscess, in which the fetor of the nasal discharge rendered the patient an object of disgust. He was relieved by establishing through drainage in the cavity of the first molar, which has been maintained with considerable difficulty and still requires his daily attention. In this case, although relieved, further operation from the nasal side is recommended.

The fifth case was one that had been operated on before; there was a small sinus in the root cavity of the first molar tooth, resulting from the former operation. A large rhinolith was found and removed from under the middle turbinate bone, while the inferior turbinate, being extensively carious, was entirely removed, and with chisel and gouge the nasal partition was broken out. Through this large opening several calcareous concretions of the nature of rhinoliths were removed. The resulting benefits of this operation were so marked that its superiority over the usual method of draining into the mouth in chronic cases was demonstrated, as it not only allows more thorough exploration and treatment, but also renders the after-care much easier, permanent drainage being secured. Experience has taught me not only that permanent drainage into the mouth is hard to maintain, but that the constant dribbling of pus into the oral cavity is very unpleasant, producing stomatitis and often dyspepsia. Mouth-drainage becomes valuable in acute and curable cases where permanent drainage is not necessary.

I shall not discuss in detail abscesses of the sphenoid and ethmoid sinuses; they should not be forgotten, however, in searching for the cause of a purulent nasal discharge. The fact should be borne in mind in suppuration of the sphenoid sinuses that sudden blindness may occur from a nerve pressure with the symptoms of deep-seated abscess. I have not had such a case. Suppuration of the ethmoid cells most frequently results in caries or orbital tumors, and careful examination will reveal its location. I have had one such case causing caries readily cured by thorough cureting. This case was characterized by deep-seated frontal headache with purulent discharge from the upper posterior portion of the nasal cavity. The following is a short history of a case of abscess of the frontal sinuses recently operated upon:

This patient, a woman of sixty, had suffered from severe frontal headache for over a year. She reported that six months previous to my examination the left eye began to bulge out and down, protuberance increasing until the globe was forced almost completely from its cavity. On examination, I found paralysis of the ocular muscles, with a hard tumor presenting at the inner and upper part of the orbit; the ophthalmoscope revealed dilated retinal veins, retina otherwise normal. Nasal examination disclosed congestive and hypertrophic catarrh; the nasal cavities were free from pus. The real nature of the case was not suspected until extensive dissection revealed a tense cyst-wall at considerable depth; this was incised, and over 1½ ounces of mucopurulent fluid evacuated. A digital examination revealed an enormous cavity originating in the frontal sinuses, with complete absorption of that portion of the orbital plate forming its floor. The inner table of the frontal bone was so thin by atrophy as to allow more or less brain pressure, accounting for the severe headaches in the past. The sharp, thin edge of the supra-orbital ridge was removed with rongeur forceps; the case was treated by drainage and irrigation with a solution of tincture of iodin, 1:50 in strength. The patient was discharged cured in three weeks.

Should simple drainage in these cases fail to effect a cure, permanent drainage may be established by trephining the frontal bone at the root of the nose and reopening the infundibulum from above down.

CENTRAL NERVOUS SYSTEM

INFANTILE SPINAL PARALYSIS*

WILLIAM J. MAYO

Frequently the only ascertainable cause of infantile spinal paralysis is that convenient scapegoat, "taking cold." Although the condition may be preceded for a short time by slight fever or dental irritation, it is never dependent upon antecedent diseases.

Usually the only history which can be obtained is that the infant, when taken up from sleep, was found to be helpless in some portion of its extremities, but otherwise appeared in perfect health. The disease may occur as late as the tenth year, but is most frequent between the ages of six months and two years. The lower extremities are the favorite seat of the disease, and the sexes are affected equally.

An atrophy of the gray matter in the anterior horns of the spinal cord is the only appreciable lesion. The origin of this is probably a sudden vascular irritation, affecting most frequently the lumbar enlargement of the cord. When the lesion is no greater than this, the paralyzed muscles may improve gradually in power in a few days or a week; but when the lesion amounts to a myelitis, atrophy of the motor cells occurs, and the paralysis is permanent. The affected limb becomes wasted and blue, the sensibility remains unimpaired, but the temperature is from 2 to 10 degrees subnormal. The bones and cartilages become atrophied, their growth is slight, and more or less deformity is manifest.

Deformities result from atrophy of the muscles, stretching of the ligaments allowing separation and luxation or subluxation of the joints, and disturbed equilibrium of the unaffected muscles. Deformities may result even when the paralyzed muscles fully regain their use. In the production of these deformities the flexors and abductors are largely at fault when not included in the paralysis.

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* "Trans. Minn. State Med. Society," 1886, pp. 143–148.

The temporary loss of function gives the balance of power to the opposition, and, by use of the limb in an unnatural position, spastic contractions of these muscles ensue, resulting most frequently in the different varieties of acquired club-foot, which are presented to notice long after other evidences of the paralysis have disappeared. The prognosis is more favorable when improvement is noted early in the disease, but after one year no further gain can be expected. We often see an apparent improvement due to the increasing ease with which the patient manages the disabled limb, but this improvement is more apparent than real.

Paralysis occurring in the upper extremities, as a rule, improves more rapidly and perfectly than in the lower limbs. The deltoid muscle in the upper, and the tibialis anticus in the lower, extremities are most frequently crippled permanently.

If the atrophied muscles fail to respond to a strong galvanic current, they have undergone fatty degeneration, and there is no hope of further recovery. When seen early, the use of ergot and the bromids may be of benefit; in the later stages strychnin has considerable reputation, given by the mouth or hypodermically into the paralyzed muscles. It should be administered in increasing doses for a length of time.

Electricity is looked upon favorably in the treatment of this disorder. I am, however, inclined to think that much of the reputation of electricity has been cheaply earned by the improvement which time effects. If our pathology is correct, how can running an electric current up and down a paralyzed limb effect an organic change in the spinal cord? Experiments have proved that any safe current of electricity will pass through not the cord, but its coverings; so, even if we would, we could not effect the lesion. The faradic current is employed if it will produce contractions; if not, the galvanic is used, until the electric sensibility is increased sufficiently for the faradic to produce a response in the muscles.

Friction and massage, with applications of heat, are of undeniable service in exercising the muscles; they tend to prevent contractions and deformities, particularly while improvement is going on.

To the physicians, the mechanical treatment is the most practical part of the subject, because the majority of cases are seen either when the atrophy is so complete as to preclude the possibility of other treatment, or the paralysis has largely disappeared, leaving permanent contractures and deformity, which cause most of the cases of acquired club-foot. In the mechanical treatment the objects in view are artificially to aid the paralyzed muscles, to give mechanical support to a useless joint, and to overcome spastic contractures of opposing muscle-fibers.

In the comparatively rare cases of deformity of the upper extremity the extensors are most liable to be affected, and flexion of the fingers and of the hand on the arm may occur. If spastic contractions of the muscles take place, tenotomy may be required, with the subsequent application of rubber muscles. I have never treated a case in which permanent deformity of an upper extremity was due to contractures. The deltoid muscle, which most frequently remains powerless, cannot be greatly benefited by mechanical treatment.

In the lower extremity, if an entire limb be paralyzed, an appropriate apparatus will often convert a useless appendage into a natural peg-leg; this may be accomplished by a modified hip-joint splint consisting of a long outside rod of steel extending from the crest of the ilium to the sole of the foot, with a stout body-piece bolted firmly at its upper extremity, to which can be fastened perineal straps; the knee and ankle can be fastened to this splint by straps, the inferior extremity ending in a short horizontal bar projecting inward; to this the shoe is riveted.

The practical working of the splint may often be enhanced by a joint at the external malleolus, allowing motion of the foot upward, but not downward, below a right angle; this prevents the toes dropping, and allows the foot to clear the ground without the side motion otherwise necessary. If the limbs be of equal length, it will be necessary to lengthen the sound limb slightly by addition to the sole of the shoe; but as the sound limb rapidly outgrows its fellow, the length must soon be added to the splint. When lesser portions of the limb are affected, shorter splints, consisting of internal and external steel rods, are easily made to suit the deformity by any blacksmith. Care should always be taken that the joint allows no motion of the foot below a right angle.

The variety of club-foot caused by normally contracting muscles overpowering atrophied opposition is most easily remedied by the use of rubber muscles applied to imitate the surgeon's hand in relieving the malposition. Provided the bones are unchanged and there are no spastic contractures, I have found the ordinary hooks used by ladies in fastening their dresses of service. These set into strips of heavy mole-skin plaster, one applied at the point of fixation desired on the leg, and one or more attached to the foot as the movable point; over these a roller bandage is applied, allowing the hooks to project; by connecting these hooks with rubber pocketbook bands of the requisite strength, elastic traction can be made to relieve the deformity.

Spastic contractures are caused by the use of the limb in a malposition while the paralyzed muscles are slowly regaining power. In these cases tenotomy of the contracted tendons and fasciæ may become necessary. In this expedient I have found that a sharply defined tendon, under an anesthetic, becomes so relaxed as to interfere with its division; as the pain is not great, I prefer the ether spray or cocain hypodermic to general anesthesia. After tenotomy the foot may be bandaged to a bent copper splint, and later a simple brace attached to the shoe. Often tenotomy may be avoided by forcing the foot into the required position and fixing it with the gypsum bandage. If the case be one of equinovarus, overcome the varus in this manner first, dividing the tendo Achillis later.

Frequently a muscle temporarily paralyzed and long overstretched by spastic contractures of opposing fibers will rapidly regain power after the contractions have been overcome. Where muscles are slowly regaining power after temporary paralysis, the tendency of the antagonistic muscles to produce deformity may be counteracted by the application of a bandage or adhesive strap drawn in the proper direction.

The so-called "infant's kicking board" consists in fastening the soles of both feet in normal position to a board, which is easily fashioned from a cigar-box cover, until the muscles shall have regained their strength.

Contractures holding the foot in an abnormal position while the bones are deformed in their growth may require exsection of one or more of the tarsal bones to relieve the disability. It has been suggested to excise lax joints, forming bony ankylosis, and thus convert a useless limb into a natural crutch. Because of the lessened vascularity and nutrition of the paralyzed limb, which might prevent union, I doubt if this method will be frequently resorted to.

A CONTRIBUTION TO CEREBRAL SURGERY—REPORT OF TWO CASES*

CHARLES H. MAYO

Case I.—*Cerebral Abscess; Operation: Recovery.*—June 10, 1890, Miss C. J., aged seventeen years, was admitted to St. Mary's Hospital with the following history: About one month previous, while attending school, she was taken with a severe pain in and about the left ear, which was relieved in a few days by a discharge of pus from the meatus. The discharge ceased in a few days and she returned to her studies. After two weeks of ineffectual school work, complaining of more or less headache, she was again taken with severe pain in the left ear, and during the following night had three spasms, epileptoid in character. The next day the ear again began discharging, and she returned home, where she remained about ten days before coming to the hospital. During this time she suffered from increasing photophobia and intense pain in and behind the left ear, loss of memory, and cold sweats. At the time of admission there was profuse suppuration from the middle ear. Pulse, 52; temperature, 98° F.; respirations, 18.

On the morning of the eleventh day, pulse, 44; temperature, 96° F.; respirations, 18. Complained of great pain over the left side of head, with some tenderness on percussion over the mastoid, without redness or swelling.

The mastoid was opened with a gouge chisel, and pus found in the cells, at a depth of ¼ inch. With a bone curet a sinus leading into the antrum was enlarged, and also a sinus leading upward to a small space between the dura mater and skull, evacuating in all about 1 dram of pus. The opening was drained and kept open for three weeks, when it was allowed to heal.

At the time of the operation her pulse was 40; temperature, 96° F.; shortly after the pulse reached 75, while the temperature remained at normal during her entire stay of one month. The pulse during the first week ranged from 58 to 70, and the last three weeks from 70 to 84.

*Reprinted from "Northwestern Lancet," 1891, vol. xi, pp. 59, 60.

All headache was relieved, and the suppuration from the ear ceased in a few days. The photophobia passed away, but was followed the first few days by a partial paralysis of the right external rectus, existing about a week.

The patient returned to her home apparently well, regained her normal health and weight, and remained so during July and August and up to the middle of September, when she returned, complaining of intense pain over the left side of the head and through the eyes, the pain being worse at night. Also complained of a loss of power in the right arm and hand, with a slight loss of control over the right leg. The pulse was 70 while sitting, but became very rapid on slight exertion. The ophthalmoscope revealed congested and greatly swollen discs in both eyes. I kept her under observation a few days, her pulse averaging 90 in the morning and 100 in the afternoon.

On September 25th she was again admitted to the hospital. Vision greatly impaired; partial paralysis of right arm and somewhat less paralysis of right leg; tongue deflected to the right. Complained of great pain over left side of head. Temperature, 98.5° F.; pulse, 70 while quiet in bed, increasing to 130 with the effort to sit up. It was evident that she was failing rapidly, and on September 27th, after the usual antiseptic precautions in the preparation of the head, I opened the skull with chisel and rongeur forceps, at a point 1½ inches above and behind the left external meatus. The opening was 1 inch in diameter, and the congested dura mater bulged perceptibly. Exploring with a hypodermic needle, pus was found directly beneath at a depth of ½ inch. The dura mater and cortex were now freely incised, and 10 drams of inodorous pus evacuated. A drainage-tube was inserted, and the cerebral substance tamponed about the drainage-tube with iodoform gauze. The cavity was treated without irrigation, and the tube left ten days. Manipulating the tube on the second day, a discharge of 4 drams was obtained, and again on the fifth day 2 drams more, while the antiseptic moss pads used in dressing showed that some pus was continually draining.

Power rapidly returned to the right arm and leg, while the deflection of the tongue disappeared. Her temperature remained normal during her stay, the pulse ranging from 80 to 100. She was discharged October 19th, the wound entirely healed.

On a later examination, December 1, 1890, the swelling and congestion of the optic discs were greatly improved. Vision, 20–30 in both eyes; paralysis entirely disappeared, and she expressed herself as feeling very well.

Case II.—*Arteriovenous Aneurysm in Cavernous Sinus.*—In February, 1890, Mr. S. J., aged fifty-six years, came to me for relief from a squint. He gave me the following history: One year previous, in a runaway, he was thrown from a wagon, his head striking a post. He was picked up insensible and bleeding from the ears and nose. After his return to consciousness, which did not occur for over three weeks, intense headache and dizziness were complained of. The right eye had remained turned from the time of the injury, while the left began to turn inward about three months previous to my examination. He had been unable to work, and the pain and vertigo gradually increased. Upon examination I found paralysis of the right external rectus. The veins in the sclerotic and conjunctiva of the right eye were dilated and pulsating, as were the right angular vein and right superior palpebral veins, the eyeball having a perceptible impulse synchronous with the heart-beat. The ophthalmoscope revealed nothing but a somewhat congested retina. The hearing was reduced to watch contact in both ears. A distinct bruit could be heard, either with a stethoscope or with the ear placed in contact with the patient's head, more noticeable at the right ear. Deep pressure on the right common carotid stopped the bruit and the pulsations in the veins, also relieving the headache and vertigo. On March 10, 1890, at St. Mary's Hospital, after completing the diagnosis of aneurysmal varix in the cavernous sinus, I ligated the right common carotid. Immediately upon tightening the ligature the patient had several slight epileptoid spasms, the right side of the face blanching, and symptoms of profound shock were manifest, but were quickly relieved by hypodermics of brandy. The eyeball settled back to nearly its normal depth, the pulsations ceased, and the bruit disappeared.

In a week's time the wound was healed, and the patient up and about the ward; but on the fifteenth day slight pulsation was felt above the seat of ligature. There had been absorption of the catgut ligature, with a partial reopening of the lumen of the vessel, but the stricture produced in the vessel by the operation was sufficient greatly to reduce the circulation and give relief. Although there was a partial return of the symptoms, he has had but little pain, and has been able to work at his occupation of farm laborer during the last ten months.

THE SURGERY OF INJURIES AND DISEASES OF NERVES *

CHARLES H. MAYO

It is hardly necessary to do more than mention the several varieties of traumatism producing nerve injury, as fractures, wounds, diseases, etc. The nerves of the upper extremity are most frequently involved because of injuries inflicted by sharp-pointed or cutting instruments and phlegmonous processes. Injuries by compression and the results of dislocation or fracture are of frequent occurrence. Stimson recently reported an interesting case in which a fracture of the humerus severed the musculospiral. The nerve was sutured, but its function was lost for nearly two years. Many cases of peripheral neuritis follow dislocation of or even slight injuries about the shoulder-joints, which require rest for a few weeks. The effusions or hemorrhages into the periarticular space may bind down certain nerves with the resulting adhesions, and the only relief is in forced motion; such injuries have been fully described by Bird. Many cases of paralysis, usually temporary, occur following injuries of the brachial plexus. I recall one case in which a railroad employe was thrown forward, striking on his shoulder, by the sudden stopping of a train. A peripheral neuritis followed, which was considered permanent, and the company settled the claim of damages within a few months, paying a large sum. One year later the arm was restored to full usefulness. It is well to bear such cases in mind.

In many instances nerve injury is unavoidably produced by the surgeon, such as section of the spinal accessory in the removal of tuberculous or other tumors from the cervical region, or injury of

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* Read before the Department of Surgery of the Minnesota State Medical Society, June 16, 1892. Reprinted from the "Northwestern Lancet," September 15, 1892.

the facial nerve in operating about the parotid gland; also in the removal of the tympanic ossicles by severing the chorda tympani, and in Phelps' operation for club-foot by cutting the plantar nerves. There are other cases of neuritis or neuralgia following compression or irritation of the new-formed tissue, such as the adhesions following fractures, producing paralysis some time after injury. The neuralgia in the region of tumors and cancerous growths, which in some instances is best relieved by section of the nerve, as cutting the gustatory nerve in cancer of the tongue. To follow the neuralgia of pressure still further, we have the Morton's foot, in which Morton advises excision of the head of the fourth metatarsal bone.

Before considering the intentional operations upon nerves, a thorough understanding of the pathology of nerve injury becomes necessary.

A nerve that is severely bruised or stretched or cut across begins to degenerate in all the peripheral parts at once. The myelin runs into cylindric masses, which become granular and fatty, at last disappearing. The axis-cylinders split up into fibers and disintegrate, so that they can hardly be recognized in the second week, and the nuclei of the sheath increase in size and number. In two or three weeks the whole peripheral part is atrophied. The central end changes in like manner, but only for one or two nerve nodes in extent; all above remains unchanged for years. While this degeneration is the rule, we have exceptions which occur in some cases in which immediate primary union of the nerve-trunk has taken place. Such a result has been secured in many of the experimental operations upon animals, but, unfortunately, is not often seen in man, although several cases are reported. Gluck, an enthusiastic experimenter, in many operations upon the sciatic nerves of fowls and rabbits, making complete section and suturing the divided ends, was gratified to see a return of function in two or three days in many instances. Such results are not to be expected, however much they may be desired. Immediate suture, even when apposition is exact, usually requires weeks, if not months, for a return of function.

Bolby describes a process of regeneration of the degenerated nerves, a change which may take place in a few weeks, but usually is delayed six or seven months after injury. The nuclei of the sheath increase in number, become spindle-shaped, and arrange themselves in rows in the spaces of the perineurium, and gradually assume the structure of fibrils around which myelin develops. It is such a process which makes possible the secondary suture of nerves. After such a regeneration, if the divided ends are not approximated, permanent degeneration takes place. If union does not occur, the spinal end of the nerve remains unchanged, or possibly forms a nerve-bulb, such as is seen after amputations, such enlargements consisting of an increase of connective tissue, and in most cases new nerve-fibers are also found in abundance.

The immediate symptoms of a nerve injury are such as relate to sensation and loss of power in the parts supplied by the nerve. Because of the frequent anastomosis of nerves, signs afforded by loss of or perverted sensation are not always easy to analyze, but a loss of sensation over all the region supplied by a nerve is positive. Loss of muscular power is equally positive, provided that it is followed by the reaction of degeneration. Such a reaction means a rapid wasting and loss of faradic excitability, with the continuance for a time, or even a temporary increase, of galvanic excitability of the muscles supplied by the injured nerve, which gradually decreases until no effect is produced by any electric current.

The secondary changes are those of atrophy of the muscles and connective tissue; the skin becomes glossy and smooth, the hair disappears, fibrous ankylosis of the joints involved follows, the nails become curved, especially laterally, and occasionally perforating ulcers appear, particularly about the feet. These perforating ulcers are of the same character whether following the neuritis of diabetes or due to section or injury of the nerve-supply. I was recently fortunate enough to observe a case of perforating ulcer of the heel due to a mangling of all the posterior tibial structures in a mowing-machine years before. Ulcers of this character, as well as the more common perforative ulcers of the foot following sclerosis of the spinal cord, are usually healed with treatment and rest, but are liable to again return at or near the same location. It is surprising how little was known concerning these cases until Savory and Butlin prepared extensive reports on the subject in 1879.

The contusion, compression, and stretching of nerves may be considered together. The changes, if the lesion is severe, are similar to those described under degeneration and regeneration of nerves. The severity of the injury determines the amount or form of the paralysis, also the length of time before a recovery of function takes place, and while the injury may be so severe that the primary loss of sensation and paralysis is obscured, and even in some instances secondary changes of atrophy or loss of faradic excitability ensue, the prognosis is good, while the continuity of the sheath remains unbroken.

This brings us to the intentional operations upon the nerves. These may be divided into—(1) Nerve-stretching; (2) neurotomy, or section of nerve-trunks; (3) neurectomy, or excision of a portion of nerve-trunk; (4) neurorrhaphy, or suture of a divided nerve-trunk, immediate or secondary; (5) nerve-grafting, or the splicing of shortened, divided nerves.

The operation of nerve-stretching was first intentionally performed by Nussbaum in 1872. This procedure has since been applied to all the nerves of the body probably from the optic nerves down. We all remember how much of the original medical literature of two years ago was devoted to the report of cases of all kinds of spinal paralysis cured or improved by suspension. The best effects of nerve-stretching were seen in certain cases of sciatica and of peripheral neuritis, and in some forms of neuralgia and spasmodic contraction of muscles. The direction of the traction affects the result; if made in a direction away from the cord, anesthesia is more marked than the paralysis; if in the opposite direction, the reverse is the case. Horsley, in describing nerve-stretching, says: "The nerve being firmly held between the finger and thumb, steady traction is made for five minutes first away from and then toward the cord for a like period." Smaller nerves may be stretched over an aneurysm needle. This operation is capable of wide application, as in most cases it will precede the operations of neurotomy or neurectomy because of its simplicity in performance and from the fact that the other more serious operations depend upon the result, temporary or permanent, following the nerve traction; also it may be deemed advisable to operate a second time, making more extensive traction, rather than to at once induce a paralysis by section or excision of a portion of the nerve.

The supra-orbital nerve is operated upon for severe cases of frontal neuralgia, the nerve being exposed as it passes up from the supra-orbital notch.

The superior maxillary nerve is often dealt with in the treatment of neuralgia of the upper teeth. This nerve gives off three dental branches, and to obtain any effect upon them the nerve must be exposed between Meckel's ganglion and the infra-orbital canal. Carnochan was the first surgeon to excise this nerve. His operation was to open, through the antrum of the superior maxillary bone, and opening its posterior wall with a trephine, to grasp the ganglion and cut off above with slender scissors. Chavasse has collated 20 examples of this operation, and in only 3 did the relief appear permanent. Treves has operated 5 times without a permanent success. Several other methods of operating upon the nerve have been described by various operators, all proposing some method of reaching the sphenomaxillary fossa from the side by section of the zygoma or through the malar bone. Treves, speaking of this neurectomy, says: "These operations are all needlessly severe, and involve wounds of great and unnecessary magnitude; since it is to be questioned whether the neurectomy is of permanent value, the operations described can hardly be justified by the results obtained." Operations upon the third division of the trifacial nerve are made in a similar manner, by removing temporarily the zygomatic arch and reaching the nerve in the sphenomaxillary fossa. The inferior dental, the largest branch of the third division of the fifth, may be exposed from within just as it enters the bony cavity; the operation wholly performed in the mouth becomes very tedious and bloody, but is the one recommended. The nerve is more commonly exposed in the canal by external incision and trephining or chiseling away the bone to reach the canal.

The removal of the Gasserian ganglion has been recorded a few times recently, 2 cases by William Rose reaching the ganglion through the sphenomaxillary fossa; 2 cases by Edmund Andrews, who, with Rose's incision, trephines the floor of the skull and gnaws through to the ganglion, removing it with sharp curets; and 1 case by Horsley, who trephines in the temporal fossa and removes the nerve by avulsion from within the skull.

Section has been made of the buccal and auriculotemporal nerves. The facial nerve has repeatedly been stretched for facial tic, many fairly successful cases being reported, although but few stood the test of time. The various cords of the brachial and cervical plexus may easily be exposed for operation. Within the last few years several cases of operation upon the spinal accessory have been reported. The nerve is readily exposed on either side of the sternomastoid muscle. In operating upon this nerve for the relief of spasmodic torticollis, if the result obtained is only partially successful, due to the involvement of the deeper muscles, a secondary operation may be made upon the upper branches of the posterior cervical nerves, as described by Keen and Bull recently for other forms of complicated wry-neck. The nerves of the extremities are readily accessible for operation, the technic of which is similar to the ligation of arteries. Several cases of severe intercostal neuralgia and muscular tic are reported as benefited by stretching or section of the intercostal nerves. A few cases of stretching and section are reported herewith.

Case I.—*Neurotomy of the Spinal Accessory.*—Miss W., aged thirty. Had suffered from a gradually increasing spasmodic wry-neck for the past five years, so marked at this time that she was unable to work at her occupation of sewing. She had been subjected to all kinds of nerve tonics and electricity, and was becoming very hysteric. I operated on this patient nearly a year ago, making section of the spinal accessory before it enters the sternomastoid. There has been complete relief from the spasm since; the patient has gained in weight, and there is a marked mental improvement. It is possible to improve on this operation by separating and stretching the branch of the spinal accessory which supplies the mastoid muscle, and thereby prevent a paralysis of the trapezius and consequent loss of contour of the shoulder.

Case II.—Mrs. F., aged thirty-three years. Had suffered from sciatica of right leg for twelve years, and for the past two years employed crutches in moving about. I cut down upon and stretched the sciatic nerve, using a force of 20 to 25 pounds; after two months' rest she was enabled to go about without crutches. There was full motion and comparative freedom from pain; such relief has now lasted one year.

Case III.—Mr. E., aged fifty-five. Injured in the left wrist by a hay-fork when he was thirty years old. In the resulting phlegmonous process his hand and wrist became crippled and useless. For the past five years there has been an increasing tremor and pain confined to this arm. In a belief that his symptoms were due to an irritation of a nerve bound down with adhesions in the hand and wrist, I made a neurectomy of the musculospiral and of the ulnar, but there was little relief following the operation, and a few months later the forearm was amputated at the upper third.

Case IV.—Mrs. F., aged thirty-four. Has suffered for the past year from a severe neuralgia of the left forearm and hand, limited to those parts supplied by the ulnar nerve. The nerve was stretched above the elbow, and with the return of motion the pain was again present and the neuralgia still persists.

Case V.—Mr. K., aged forty-five. Had suffered for three years from a severe form of neuralgia of the left inferior dental nerve. He had all the teeth on that side extracted without relief. The nerve was exposed in its canal by the chisel, and the nerve torn out at the highest point. The patient has been greatly relieved for the three years since the operation.

Case VI.—Mrs. Q., aged fifty. Recently came under my care for a neuritis of the circumflex nerve; she suffered from constant neuralgia in the arm and shoulder, with limited motion. The adhesions were broken up under ether, and after a short treatment of massage and forced motion, the symptoms were relieved.

Case VII.—Female, aged forty. Has suffered neuralgia in the left supra-orbital region for several months. The supra-orbital nerve was exposed and stretched. Partial relief was obtained, which was the condition several months after, when the case passed from observation.

It will appear to one reviewing the literature of this subject that nerve tissue is as capable of sustaining operative interference as the other structures of the body. The needle best adapted for passing the sutures is the common round sewing-needle or a very thin flat needle. These will injure but little of the nerve structure. In large nerves the sutures may be passed directly through the nerve, while in the case of the smaller nerves, in many instances it will be found sufficient to appose the cut ends by suturing the sheaths. In some instances the nerves will have retracted, as in secondary suturing, after freshening the ends or removal of a nerve-bulb; the ends may still be approximated, although quite a space separates them, by stretching the nerve both ways. In such cases it will be best to insert a few stay sutures into the sheath and surrounding tissues to prevent too great a traction upon the ends. It has been proposed to make an incision half through the nerve-trunk as far from one end as they are separated, and splitting back nearly to the end, then reflecting the flap obtained to connect the two ends. When the distance separating the ends is deemed too great to be bridged by these methods, nerve-grafting should be tried. Atkinson reports five cases of nerve-grafting which he has collected, all more or less successful.

One case is reported by Mayo Robson, in which 2½ inches of the median nerve was removed in operating upon a tumor of the arm. Twenty-four hours later 2½ inches of the posterior tibial was removed from a leg just amputated and sutured to the ends of the divided median. Thirty-six hours after there was slight return of sensation, and five weeks later sensation and use were restored. The muscles of the thumb were still somewhat wasted, but not completely paralyzed. Another case reported was one in which two of the sciatic nerves of rabbits were inserted to connect the widely separated ends of a nerve, and although suppuration followed, a successful result was obtained. The small neuromata found on cutaneous nerves are of frequent occurrence, especially about the elbow. Their removal presents no difficulties, and the relief is immediate.

THE PRESENT STATUS OF BRAIN SURGERY *

CHARLES H. MAYO

The last five years marks a wonderful advance in the special work of brain surgery. Within this period operations upon the brain have been performed for the relief of pressure, removal of clots, excision of tumors, drainage of abscesses, and for the relief of epilepsy, imbecility, and insanity. Such operations have been rendered possible by our present facilities for accurate diagnosis and localization, the result of the work of many observers of the past decade.

Craniotomy has been performed repeatedly for microcephalus and kindred conditions, the hopeless medical treatment of which has served as a stimulus to surgeons to attempt their relief by operation. Starr gives a report of 34 collected operations for this purpose, of which number 14 died from the operation. While the results of surgical interference at the present time cannot be said to be satisfactory, the partial relief afforded some of the patients will encourage further investigation.

Operations for the relief of congenital malformations characterized by the protrusion of intracranial contents are becoming of frequent occurrence. The little sufferers from encephalocele, hydrencephalocele or meningocele need not be looked upon now as inoperable cases. These tumors, from their location, are sincipital or occipital, the former being the more favorable condition for operation.

The following case is an illustration of the modern treatment of this class of patients, who have heretofore been considered almost absolutely hopeless:

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* Reprinted from "Trans. Minn. State Med. Assoc.," July 15, 1893.

April 1, 1893, G. C., aged eighteen months, was admitted to St. Mary's Hospital for the relief of a congenital, pulsating, occipital hydrencephalocele the size of a "glove" orange. The tumor was found to be communicating with the right ventricle, and was treated by a clean excision without drainage. The child made an uneventful recovery.

Trephining for the relief of insanity following injury to the head has been performed, but with little success; the same can be said of the results following operations for the relief of general paresis.

Cases of trephining for headache have recently been reported by Horsley and Weir. These cases resulted from blows upon the head without fracture, and had resisted all medical treatment. The operations were successful. John Chiene has reported such operations for the relief of headache resulting from brain tension due to the growth of inoperable tumors, removing large areas of bone and thus alleviating great suffering. Rose and Andrews report intracranial neurectomies by nearly similar operations, but the method recently practised by Hartley seems preferable in these cases.

Injuries of the head should receive the same care and attention that we give to wounds of the abdominal cavity. In a discussion of this subject at the meeting of the American Surgical Association, 1891, it was the consensus of opinion that all accessible depressed fractures, whether simple or compound, whether they produced symptoms or not, should be elevated. Even fractures with clot-pressure at the base of the skull have been successfully operated upon.

Frederic S. Dennis proposed a thorough disinfection of all cavities communicating with basal fractures, *i. e.*, the antiseptic tamponade of the nose and ear. The advantage of such treatment is evident and well worth attention.

In some cases of severe hemorrhage from fracture it may be necessary to follow a fissure or crevice, opening with the gouge and rongeur forceps until the lacerated vessel is exposed.

I interpose two recent cases illustrative of certain conditions occasionally met with from hemorrhage:

W. S., male, aged fourteen years, was admitted to St. Mary's Hospital January 28, 1893. He had been kicked by a horse the preceding evening. The boy bled from the nose and vomited dark blood at intervals during the night; mental condition dull, with marked symptoms of compression. A compound, depressed fracture of the right frontal sinus, extending well up upon the frontal bone, was found. The wound being freely exposed, the outer table of the frontal sinus was seen depressed, and upon removal the inner table was found also depressed about one-third of an inch over an area of about 1 square inch, extending above the sinus; the hemorrhage was from a vessel of the diploë, and this communicated with the nose through the frontal sinus, and was controlled by plugging with a section of catgut ligature.

The depressed bone was raised, the wound cleansed, all the bone-chips reimplanted, and the incision closed without drainage. Antiseptic tamponade of the nose was practised, which prevented infection from below. The recovery was rapid and complete.

Mrs. B., admitted to St. Mary's Hospital September 7, 1892, with a compound fracture of the right parietal bone, the result of a railroad accident. The patient was unconscious, suffering from severe shock, withfree hemorrhage from the nose, mouth, and ear. The wound area being exposed, a large depressed fracture was discovered, with a fissure passing down and forward to the base of the skull. The depressed bone was elevated and the clot removed, but the hemorrhage continuing, the line of fissure was opened by gouge and bone forceps until the middle meningeal artery was exposed and ligated; the bleeding at once ceased, and complete primary union was obtained, with recovery.

The treatment of epilepsy by trephining has received considerable attention of late. The ordinary idiopathic epilepsy is not amenable to cure by any form of surgery under discussion. Jacksonian epilepsy as a form in which the spasm is localized, or in which the fit begins always in a certain set of muscles, later becoming general, with or without the loss of consciousness, is very properly treated by trephining, the medical localization being accepted for the trephining area rather than the scar, depressed fracture, or sign of previous injury at a distance. In those cases in which nothing of pathologic interest is found it is best to locate the exact area controlling the muscles first involved in the spasm, and excise the spot. The resulting paralysis is usually temporary.

Wood says that in those cases in which the epileptic habit is developed the bromids should be continued for a long time after the operation. Of course, we recognize the fact that in many of the secondary operations the relief obtained must necessarily be temporary, as our site of operative injury may be followed by similar conditions to those resulting from the primary injury. This cannot be foretold before inspection. In cases of general epilepsy following injury the operation must be exploratory, as the cause will seldom be found.

Hemorrhage, with consequent pressure, following injury should be subjected to trephining; also selected cases of spontaneous hemorrhage. The fact is well understood that epilepsy or insanity frequently results from adhesions or the pressure of an organized blood-clot or local atrophy following the inflammation.

Macewen presented a paper on the subject of hemorrhage in 1888, having operated upon his first case in 1879. During the past fifteen years about 30 cases of successful removal of clots from the brain have been reported.

Gunshot wounds of the brain should be freely exposed, the bullet removed, if possible, and the wound drained. Punctured wounds usually produce more or less depression or splintering of the internal table, and should be freely exposed.

Brain abscess: (1) Those resulting from traumatism, with or without fracture; (2) as a result of suppurating processes in neighboring cavities; (3) by metastasis in general septic conditions. The opening through the skull for the relief of such conditions must be of ample size to allow thorough exploration, and the abscess cavity must be drained until it closes from the bottom.

In using exploring instruments the direction in which they are thrust must be maintained until they are withdrawn. The membranes are kept as free from pus as possible by frequent dressing. Nearly three years ago I operated for an abscess of the brain occurring some months after an acute suppurative process of the middle ear; over one ounce of pus was removed in this case, and I am glad to state that the patient is alive and well at the present time. This case was reported in the "Northwestern Lancet," February 15, 1891.

Brain tumors occur with nearly equal frequency in childhood and adult life. Glioma and sarcoma are found with about the same frequency under twenty. Carcinoma is more frequent in adults, as is gumma. Starr believes the gumma to be the most frequent form of brain tumor among adults. Cystic tumors arise either in connection with malignant growths or as a result of a parasitic affection.

There has been a considerable difference of opinion with regard to the removal of tuberculous tumors. Von Bergmann is reported as saying that these tumors should not be operated upon. English surgeons are making the operation with success; American surgeons have been less fortunate.

Tumors diagnosed as gumma should be treated medically for three months; then, if unsuccessful, surgical relief is indicated. Cases of brain tumor in which the location is considered as near the cortex, in the convexity of the brain, should be submitted to operation. The encapsulated tumors are more easily removed, and with greater prospects of success.

Operations for hydrocephalus and the relief of acute intracranial pressure are being made with increasing frequency. A review of cases reported will show that drainage of the lateral ventricles is a possible and fairly safe operation, and when the condition is not the result of some incurable disease, much benefit or a cure may be effected. Keen reports a case in which the ventricles were drained forty-five days. Trephining for septic meningitis, although recently proposed, will probably not become popular because of its surgical difficulties. Septic thromboses of the sinuses are amenable to treatment and drainage by trephining.

Many operators prefer chloroform to ether as an anesthetic, as it produces less congestion of the cerebral vessels. The markings for cerebral localization should be made with iodin before giving the anesthetic, and just before the incision all important points may be noted by punctures in these lines and a scratch upon the bone to preserve the landmarks after retraction of cut tissues. Hemorrhage is best controlled by hot sponge pressure, and when from a bony channel, the edge of bone should be crushed or the opening plugged with catgut and cut short. As a rule, bone chips should be reimplanted, and drainage is seldom necessary to produce the best results.

BRAIN CYST THE RESULT OF INJURY, CAUSING APHASIA, HEMIPLEGIA, ETC.: EVACUATION; RECOVERY *

CHARLES H. MAYO

On June 30, 1893, Miss S., aged eleven years, was thrown from a wagon in a runaway. The child was picked up unconscious, bleeding freely from the nose, and while being carried to the house had a severe vomiting spell. There was a small scalp wound on the anterior part of the left parietal bone, while about the right eye, cheek, and temple there were extensive ecchymosis and swelling. Consciousness not returning, she was nourished the first week by rectal enemata; from the second week on she was able to swallow small quantities of liquid nourishment. There was complete right hemiplegia; the eyes were fixed in an upward direction, the left pupil being the more dilated. On the fifth day there were 25 convulsions, and these were continued for a week, becoming less frequent each day. She remained in a comatose condition for about six weeks, when she began, apparently, to notice things. Following the injury, urination and defecation were involuntary. In this condition, and emaciated to a skeleton, she was referred to my care. Her symptoms were indicative of a severe lesion about the left fissure of Rolando, extending down over the speech center. On August 18, 1893, the patient was operated upon at St. Mary's Hospital. The skull was opened by the trephine and rongeur forceps, exposing an area 2 inches by 1 inch over the left fissure of Rolando. The dura bulged into the opening, and did not pulsate until a considerable area of bone was removed. On incising the dura 4 ounces of a clear watery fluid were discharged, and upon opening up the dura freely the whole left frontal lobe was seen depressed; at the region of the Rolandic area this depression was over an inch from the skull. The fluid was between the arachnoid and the dura. The cerebral tissue expanded to a slight degree, leaving a large cavity. There was no sign of fracture in this region or beneath the scalp wound, although the dura was closely adherent

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* Reprinted from the "New York Med. Jour.," April 7, 1894.

to the skull. Catgut strands were placed so as to project into the cavity and extend out of the scalp wound, and the membrane was closely sutured with the same. The scalp wound was then closed with interrupted sutures of silkworm gut without reimplanting the bone chips.

The patient's appearance was much better the day following the operation, and her recovery was rapid. At the end of the first week she could say "no" and "yes," and those were the first articulate sounds she had made since the accident. She could also move her right arm and leg. At the end of the third week she was able to sit up and ask for the food she wanted, and four weeks after the operation she was discharged from the hospital, and in three weeks from that time was able to move across the room alone and to talk quite freely. She has no recollection of events from the date of the accident to that of the operation, and but little during the week following. The condition was probably degenerative cyst resulting from the severe injury. Chloroform anesthesia was employed.

Note.—A letter from her mother, received three months after operation, says that the child plays about with other children and that she considers her perfectly recovered.

BRAIN CYSTS *

CHARLES H. MAYO

Among a series of 6 brain operations performed within the past year for various local lesions entirely independent of any acute injury,—1 of monoplegia, 4 of traumatic epilepsy, and 1 of Jacksonian epilepsy,—3 well-marked brain cysts were found. The literature of the subject of brain cysts is very meager, aside from the short reports of cases found, and for the purpose of eliciting discussion, a short history of these cases will be given. Cysts in general are usually classified with tumors, and according to the nature of their contents they are called serous, mucous, sanguineous, parasitic, etc.

Brain cysts occur as exudation cysts resulting from excessive secretion; extravasation cysts resulting from extravasation into closed cavities; cysts produced by a softening of the tissues common in new formations; cysts from extravasation into solid tissues; cysts formed around foreign bodies and by extravasated blood and by parasites.

The arachnoid is the serous membrane of the three brain envelops, and by its secreting cells and inclosed lymphatics with the choroid plexus of the ventricles furnishes the cerebrospinal fluid, consisting normally of about 2 fluidounces. It has been shown experimentally that injections thrown into the subarachnoid space permeate the Pacchionian bodies and thus pass into the venous sinuses, with which these bodies are connected; that the injection distends the subdural space of the Pacchionian body, but does not enter the general subdural space, and that these bodies form the outlet for the cerebrospinal fluid into the venous system (Morris). It is probable, then, that an injury of sufficient extent to produce a ring of adhesions between the membranes, or between membranes

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*Reprinted from "Trans. Minn. State Med. Soc.," October 1, 1894.

and the brain, might inclose a secreting surface which would be cut off from any outlet into the venous system.

The majority of all cases of brain cysts uncomplicated by malignant growths are formed or partially formed by the membranes of the brain, the arachnoid forming the inner or outer wall, although some are reported as between brain and pia mater or beneath the cortex. The larger number of these are traumatic, and may be classed as exudation cysts or as cysts formed around foreign bodies or by extravasated blood, called by some writers "cystoid scar." These fluid tumors are very rare in the cerebellum, because of its better protection from injury. Cysts of the frontal or occipital lobes of the brain are usually of large size, because operation is naturally reserved until they encroach upon the motor centers, unless the operation is done strictly for epilepsy. A sufficient number of operations have now been made upon this class of cases to lead us to suspect cysts at least in those cases of brain trouble giving a history of old traumatism.

All proper motor, sensory, and psychic brain functions depend upon normal cell action, and in many of these cases, even where we are apparently able to relieve the lesion, we are not able to restore the normal equilibrium of the brain after its exposure to excessive discharge of function, the "fit" habit being established. The works of Macewen, Starr, and Horsley give many cases of cysts found in operations for traumatic epilepsy. Von Bergmann has given this subject especial attention, and in his work may be found reports of a large number of his own cases and those of other operators. My first case is one which was reported before the Minnesota Academy of Medicine in February, 1894, and I will give a brief history of the case:

Case I.—Miss O. S., aged eleven years. On June 30, 1893, she was severely injured about the head in a runaway accident, and was picked up unconscious, bleeding at the ears and nose and vomiting. There was complete right hemiplegia, which continued, with the unconsciousness and stupor, for eight weeks. During the latter part of the first week there were frequent spasms. After remaining in this condition two months she was brought to St. Mary's Hospital, where, after thorough preparation, I exposed the dura over the left fissure of Rolando, using trephine and rongeur, exposing an area 1 inch by 2. There was no pulsation, and upon incision of the dura 4 ounces of a clear fluid discharged. The brain was depressed over 1 inch in this region, and the arachnoid formed the inner wall of the cyst. The cavity was drained with catgut strands and the wound healed uneventfully, and now, at the end of nearly a year, the girl is attending school, entirely well.

Case II.—A. P., male, aged seventeen years. This boy, when seven years old, had his head caught in a horsepower machine and the end of a bolt crushed into the skull behind and above the right ear. Fragments of bone, together with considerable brain substance, were removed, and the wound healed in a short time. The boy was fairly bright, and experienced no trouble for nine years, when he became forgetful, had severe headaches and occasional "spells," sometimes with, again without, loss of consciousness. The left arm would cramp, and the boy would take a few steps backward without falling, the spell lasting but a moment. These gradually increased in frequency and severity—often several in one day. January, 1894, he began having general spasms, characterized by falling and loss of consciousness. March 10, 1894, after the usual preparation, the skull was opened with a chisel and rongeur forceps above the seat of the scar, as this was the located center for the left arm. Upon exposing the dura there was no pulsation. The opening was extended downward, removing the old scar. Incising the dura, it was found to form the outer wall of a cyst of ½ ounce of clear fluid. The inner wall was formed by cicatricial cerebral tissue with the remains of the arachnoid and pia mater. At one side of the cyst, and connected to its wall, was a growth of bone fast to the inner table, and ¼ inch thick, irregular, projecting ¾ inch within the cavity of the skull. This was removed with portions of the cyst-sac and cicatricial tissues in the bottom of the cavity. The wound was closed with catgut drainage. The sutures of silkworm gut were removed in seven days, and the patient discharged from the hospital in two weeks. For two months following the operation, as often as once a week he had light spells similar to those first affecting him. He has been free from any attack during the past month. Bromids have been continuously given since the operation, as is my rule in such cases.

Case III.—I was called to Second Minnesota Hospital June 6, 1894, to operate upon M. B., male, aged thirty years, a patient who had been committed eight years before. His condition previous to commitment is fully given by Wood, in a letter written to the hospital shortly after his admission. It reads:

"The patient, M. B., who was recently committed from this county, is to me a rare case. Some eleven years ago he was thrown from a horse and received a comminuted fracture of the skull. A country doctor sewed up the wound, but upon stupor supervening, Rose was called, who opened the wound and removed 9 spicules and some disorganized brain matter, and twisted one of the small arteries which was spurting. The boy has been very irritable since, and has been more or less under my care for three or four years, and I have given him the bromids for epilepsy. He is dangerously irritable, especially if he can get any liquor. I wish you would trephine him if you think best."

His hospital history reports: Insane and irritable spells, with occasional convulsions until the past two weeks, during which he has had frequent spasms, finally passing into the epileptic state, with loss of power on the left side of the body. There was a depressed scar behind and above the right ear. Under chloroform anesthesia a large flap having the depressed area in its center was raised. The dura formed the inner layer of scar tissue, and upon being incised, 1½ ounces of a clear fluid discharged. The remains of the arachnoid, pia mater, and cicatricial cerebral tissue formed the floor of the cavity. Catgut drainage was used, with silkworm sutures. One convulsion, the only one up to present writing, occurred three hours after the operation. His mental condition is also markedly better.

THE ARTIFICIAL VITREOUS *

CHARLES H. MAYO

The general surgeon claims two operations from the ophthalmic specialist, namely: the removal of foreign bodies from the cornea and the enucleation of the eyeball. The enucleation of the eyeball, or its modification of evisceration, with or without the insertion of artificial vitreous, is performed for the relief of pain, to prevent sympathetic ophthalmia, for malignant diseases, and for cosmetic purposes. Panophthalmitis is many times classified separately as a special indication.

The danger from enucleation, aside from the anesthetic, is meningitis. In 11,734 reported enucleations there were 7 deaths from meningitis, all in septic cases. In 1000 cases of evisceration there was 1 death from this cause.

The modifications of enucleation have received considerable discussion during the past few years, their general purpose being to accomplish the result, which the history of enucleation leads us to expect, by an operation which will give less disfigurement. In malignant disease enucleation is done to save life as well as suffering, and cosmetics play no part. In the first irritative stage of sympathetic ophthalmia there is a probability that the free drainage given by enucleation would be of benefit in checking the further progress of the disease.

Norris and Oliver say that "experience unfortunately shows that the removal of the offending eye, even if done at the outbreak of sympathetic ophthalmia in the other, has very little, if any, influence on the final result of disease in the latter." All observers with experience in these cases know this statement to be true; but the opponents of evisceration and Mule's operation evidently expect more to be accomplished.

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* Reprinted from the "Northwestern Lancet," 1900, vol. xxx.

In the above series there were 5 cases of sympathetic inflammation following Mule's operation. They were unfortunately done too late to accomplish their purpose.

Carter, in reporting 150 cases, states that the risk of sympathetic inflammation after Mule's operation is purely imaginary. Referring to neurectomy to prevent sympathetic inflammation, there is the case of Leber, in which sympathetic ophthalmia followed two years after neurectomy, and upon enucleation the nerve was found reunited; this case has been much quoted. Other cases of sympathetic inflammation following neurectomy are reported by Clausen, Trousseau, and Schmidt-Rimpler, but it will be noted that these cases were operated upon secondarily when the eyes were already in a condition in which sympathetic inflammation might be expected, and that the disease followed in from a few days to a few weeks.

The disadvantages of enucleation are impaired mobility of the artificial eye, recession of the lids from loss of the globe, malposition of puncta, and watery and mucus-covered artificial eye. To obviate some of these troubles Belt, followed by Oliver, Frost, Risley, and others, has planted balls of sponge or various material in between the muscles, which are united over the artificial globe. This procedure is non-surgical, and reported successes are published soon after operation. Risley has abandoned the method the past year. The ordinary enucleation is a simple operation, and can be improved only by a loosely applied purse-string suture of fine catgut to center the conjunctivæ, and by the insertion of a folded strip of rubber tissue in this center, which projects between the lids for draining, and is left two days. Enucleation cases are ordinarily well in a week.

Evisceration has been performed by difficult methods. The easy method is to insert a cataract knife $\frac{1}{8}$ inch from the margin of the cornea, and, with point always toward the center of the globe, cut at $\frac{1}{8}$ inch distance from the margin of the cornea and one-half around. The loss of tension at this point will enable the operator to complete the section more readily with scissors. The contents of the globe are removed with a sharp spoon; the conjunctiva is pushed back from the margin of the sclera, and a V-shaped wedge removed from the scleral margin above and below, which is then sutured with white silk. The line of suture is at right angles with the palpebral opening. The conjunctiva is closed with black silk in a line with the margin of the lid. In panophthalmitis, or pus in the eyeball, the operation is completed by packing the cavity after removing the contents of the globe, and no sutures are used. I have done this operation with cocain. In Mule's operation a glass ball is inserted in aseptic cases, and the sutures placed as in evisceration. The size of the artificial vitreous should be such that the sclera will close without tension. Various operators use balls of celluloid, fenestrated silver, or aluminum. There is considerable reaction following this operation, and the pain is more severe and the after-care several days longer than after enucleation. Special instruments are devised to introduce the ball into the sclera. If the margin of the sclera is grasped by three forceps and pushed back to be emptied, it can be lifted up around the ball; otherwise air or blood will make the implantation difficult.

The balls are cleaned in carbolic acid and then in alcohol before insertion. In 4 of my cases in which there was some danger of sympathetic ophthalmia the advantage of neurectomy was combined with the Mule's operation. After preparing the globe for the insertion of the ball, a pair of small curved scissors were passed between the conjunctiva and the sclera, between the inferior and internal recti, and the optic nerve was severed at the usual point behind the globe. This has been done through the back of the sclera. To prevent the extreme swelling, small incisions are made at several points in the conjunctiva. The black silk sutures are allowed to remain ten days.

These cases have about three-fourths range of motion with the artificial eye, which, in front of the ball, makes an eye of normal size. The puncta and lids are in their natural position, and there are less lacrimation and mucus. If by any accident the ball is forced out, the resulting stump is better than is secured after enucleation. Eyes in which atrophy of the eyeball is taking place are best treated by evisceration and the insertion of a very small ball.

At St. Mary's Hospital during the past three years there were 33 enucleations, 8 simple eviscerations, and during the past eighteen months 13 Mule's operations. Ten of the Mule's operations remained perfect, 1 eye was pushed out within four days in a case of septic vitreous, and 2 were pushed out of atrophic eyes, 1 in four weeks, and 1 in twelve weeks, after primary healing. In both these cases the sclera was closed with tension over a small ball.

REPORT OF A CASE OF HYDRENCEPHALOCELE SUBJECTED TO EXCISION: RECOVERY*

CHARLES H. MAYO

An infant, George C., aged one and one-half years, was received into St. Mary's Hospital March 29, 1893, with the following history: He was the first child of healthy parents, and had been born with double equinovarus and a pulsating tumor about the size of a walnut projecting outward from the median line in the occipital region, which has since gradually increased in size. The child has been irritable, but in fair health. The tumor has always pulsated and been exceedingly tender on manipulation. It is of interest to note that a brother of this child, three years of age, has congenital club-feet.

Present Condition.—A bright, fairly nourished child, with a spheric tumor, pulsatile in character, the size of a small orange, projecting centrally from the occipital region. He also has well-marked congenital club-feet. The tenderness of the protuberance necessitated chloroform anesthesia for careful examination. The crest of the tumor was apparently very thin, white, and glistening in appearance, and a few veins could be seen coursing over its surface. The sides were much better protected. On the right base was a considerable thickening, probably connected in the past with the cranial contents through a lateral fissure from the central opening.

The opening through which the hydrencephalocele sprang was about the size of the tip of the index-finger.

Operation April 1, 1893. Under chloroform anesthesia two scalp flaps were dissected off from the sides of the tumor and the dura mater freed to the bony opening. The sac was opened, allowing the escape of about an ounce of cerebrospinal fluid, normal in appearance. The opening, leading inward and slightly to the right, probably communicated with the right ventricle. The sac was composed of dura mater, and near the base, spreading out thinly on the sides, was evident atrophied cerebral tissue. The neck was ligated with heavy catgut, the entire sac cut away, the tissues around the stump securely sutured over it by buried sutures, the two flaps sutured in apposition, and a dry dressing applied. During application of the dressing the child vomited, and the increase in intracranial pressure caused a marked left-sided spasm, lasting several minutes. Five grains of calomel were administered, with rapid effect, and the child made an uneventful recovery, being apparently much relieved by the operation. At the end of two weeks the child was discharged, the wound firmly united, and with no apparent pulsation at the seat of operation.

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*Reprinted from "Annals of Surgery," July, 1893, vol. xviii, pp. 23, 24.

Operations in meningo-encephalocele or hydrencephalocele have rarely been successful. Von Bergmann, in his classic work on the "Surgical Treatment of Diseases of the Brain," published in 1890, could find but few cases where the results were even encouraging. During the past two years several successful cases have been reported by Horsley, of England; Mazzucchelli, of Italy; Cabot, of Boston, and others. Considering the absolute fatality of non-operative methods of treatment, these few successful cases assume importance and place operative procedures upon a firm basis.

CYSTOID SCAR OF THE BRAIN AS A CAUSE OF EPILEPSY *

CHARLES H. MAYO

Injuries to the skull with depression or loss of bony fragments occurring in young people are often productive of cystoid scars, and the cause of epilepsy later.

Operations for the relief of epilepsy are favorable only in those cases which have received injury before the age of complete cerebral growth. The results obtained in the few cases reported in this paper lead me to urge operative procedures in all cases of epilepsy resulting from traumatism in early life. In such cases we may be so fortunate as to find the cystoid scar of Bergmann, a cyst with walls formed by cicatricial meninges, degenerated cerebral tissue, and fragments of bone, with possible spiculæ or inverted depressed edge of broken skull. The contents of these cysts, as well as of other forms of traumatic cysts of the brain upon which we have operated, has always been clear fluid. Great improvement or cure has followed the removal of depressed bone, loose fragments, or spiculæ, with portions of the cicatricial or meningeal walls of the cyst and closure of the wound with catgut drainage. We have had no occasion to use artificial or autoplastic covering for the bone opening, and it is probable that sudden cerebral tension is thereby avoided. In several operations for the relief of presumably traumatic epilepsy we found only the outer table of the skull depressed, and the conditions within were not usually amenable to treatment. One of these cases was greatly benefited by the operation, but in two others, apparently similar, there was no relief.

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* Reprinted from "Northwestern Lancet," 1895, vol. xv, pp. 394, 395.

Case I.—(St. Mary's Hospital Report No. 1545.) Arthur P. had a crushing injury of the skull behind and above the right ear when seven years old. Many fragments of bone were removed, with considerable brain substance. The wound healed, and there were no unpleasant symptoms from the injury until he was sixteen years old, when he began having partial epileptic seizures, beginning in the left arm. These spells gradually increased in severity and frequency, causing general spasms with loss of consciousness. Five months after the first attack we exposed the region of the injury, raising a large flap of the scalp, which showed a defect in the skull. Upon excising the membrane a half-ounce cyst emptied itself, leaving a cavity with walls formed of cicatricial remains of the meninges. The bone over the cavity was removed, and also a sharp spicule of bone growing inward from the skull at one side of the cavity, with portions of the sac. There was primary healing of the operative wound, and the patient soon left the hospital. For several months following the operation there were occasional slight attacks without loss of consciousness, but none during the last ten months.

Case II.—This case was reported in the "Association Journal" May 25, 1895, by Dr. R. M. Phelps, in his clinical report of the Rochester Hospital for the Insane:

"Jacksonian epilepsy, in the sense in which is meant an epilepsy with some localizing motor spasms, is rare in the advanced cases presented here. One case in which epilepsy followed gross brain injury of seventeen years ago presented itself. This man, in spite of immediate trephining, had been epileptic for some seventeen years; had been at times somewhat actively deranged mentally, but usually only when he drank, which he did at every chance. He recently, while here, began having fits more severely and showed more of mental derangement, and after some of them there remained a numb feeling, a lack of power in one hand, with some occasional involuntary motions of the fingers. These motor symptoms in a general way corresponded with the locality of the scar upon the opposite side of the head. Dr. Charles Mayo, on consultation, agreed to operate. Before consent of relatives was obtained, however, the patient went into a status epilepticus, out of which he was brought by nitroglycerin. Was then in semi-delirious condition. Operation was successful; scar was found to be not all bony, and directly under the scar was a cyst holding about two ounces of fluid. Patient had one fit the next day, but in the course of about two weeks recovered his ordinary mental state, and escaped from this place, reaching home safely." He has remained at home now over a year.

Case III.—(St. Mary's Hospital Report No. 2160.) A. S., male. This boy, now sixteen years old, was kicked on the right side of the head when he was ten years of age, receiving a compound depressed fracture. The depressed area was of crescent shape from the frontal bone to the parietal eminence. He recovered from the injury, remaining well until February, 1895, when general epilepsy began. The attacks, at the time of admission to the hospital, occurred several times a day. April 1, 1895, we trephined the depressed area of bone which formed a portion of the wall of a cyst, containing 1½ ounces of clear fluid. The patient made a rapid recovery, and up to the present time has had no further epilepsy.

It will be noted, in the report of these cases, that—(1) They all received injuries during the developmental period of life. (2) The subsequent growth of bone in abnormal position was an essential factor in the production of the cyst. (3) There was a loss of fragments of the skull at the time of the injury.

NECK

GLANDULAR TUBERCULOSIS *

CHARLES H. MAYO

Several years after the discovery of the bacillus of tuberculosis, first considered only in its relation to phthisis, bacteriologists and pathologists succeeded in classifying many of the chronic osseous diseases, as well as those prolonged inflammations of serous cavities the result of the same germ action.

Later—and not very recently either—a class of disease designated in older works by the comprehensive terms scrofula or struma, has been added to this list, and it is to these cases I wish to call attention in this paper. In a study of the causation of disease one of the most important elements to be considered is a weakness or lack of vital force—possibly a want of development of certain structures formed by one of the blastodermic layers.

In some cases we have a lack of epithelial resistance taken in a general sense.

Thus we cannot but note a peculiar susceptibility of a certain class to skin diseases, of another to lung difficulties. With but little experience we learn to read this susceptibility, and can usually elicit a concomitant family history, possibly showing whole families destroyed by this scourge or with allied diseases.

The same can be said of another class of cases marked by lymphatic weakness. It is not uncommon to treat several members of the same family for these glandular enlargements, usually found in the neck. We believe that the tonsils have more than a passing relation to the cervical glands as the bearers of infection, and are certain that they have been the medium in a few cases which we had under our care. We may recognize a diathesis, an inherited or acquired weakness, rather than an inherited disease.

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* Reprinted from the "Northwestern Lancet," August 15, 1890, pp. 261, 262.

Older observers recognized tuberculosis, or rather its results, but limited its application to phthisis, and in writing on the glandular diseases, noting the like diathesis in both cases, they did not connect the common etiology of the two.

In considering the fatal effect of tuberculosis, it is probable that death results primarily only when we have this process affecting the brain, which result is due to pressure. With the development occurring in all other places, death, as a rule, results from suppuration and its consequences, produced by a mixed infection. When occurring in the lungs, we have every advantage for growth and development by an enormous blood-supply, yielding walls having but a small amount of connective tissue and with open air-passages, encouraging mixed infection, and no facility for drainage.

In our treatment of these glandular cases we have made a thorough trial of iodin in its various forms—internally, externally, and by hypodermic injection. Locally and by injection it was found in our hands, at least, to be too irritating, in some cases seeming to increase rather than to alleviate. The result was very similar with the use of glycerin, iodoform, alcohol, and various other remedies, all these having the additional disadvantage of being very painful.

We finally concluded that it was impossible to saturate the system so as to have a destructive effect on the bacilli with internal medication. We also experimented with arsenical preparations, in one case carrying their administration to the extent of a dram a day of Fowler's solution, without relief.

So far the specific for tuberculosis has not been discovered, and we have no remedy which exerts a cell selection upon this formidable disease. Much concerning the treatment of these cases may be learned by watching nature's process of dealing with foreign bodies by absorption, encapsulation, or evulsion.

In many cases we may have an inoculation of small dosage, the gland or glands may enlarge, and by absorption or encapsulation the invasion proceed no farther, showing an individual ability to overcome a certain amount of poisoning, or we may have evulsion, evidenced by pus-formation, which eventually works to the surface, possibly not before a succession of changes by absorption and repeated softening.

Again, in a very few cases we have an inoculation of large dosage, or possibly an extreme susceptibility of the individual; in either case we have a rapid invasion of the lymph-system, and many of these cases die from general tuberculosis. This clearly gives our indication for surgical treatment.

In cases seen early first make an effort to raise the natural resistance by internal medication, combined with hygienic measures, and, failing to get absorption or encapsulation, use surgical measures to prevent further invasion. This also saves months of disfigurement, to be followed in the end by months of suppuration from ugly sinuses, which heal for a time, only to break out again in discharge, until the last vestige of the gland attacked is destroyed, while the scars thus produced seem never to be done contracting.

A correct operation is the complete removal of all glands possible, with their vessels. This requires very careful dissection, but its application is often limited, as we may not be called upon for advice until one or more glands has softened or suppurated. In such cases we assist nature's effort by opening the sac and removing its contents with a sharp curet, and do not attempt to remove the barrier already proved effective. Then, to enable us safely to leave the capsule, it is thoroughly swabbed out by chlorid of mercury solution, 1 :500, and its cavity packed with iodoform gauze, sutures of silk inserted, but not tied, and the dressing left seventy-two hours.

The iodoform pack is then removed, the wound approximated, and the sutures previously inserted tied. We employ the same method of dressing with those cases in which we have ruptured the capsule and contaminated the wound in removal.

All other glands enlarged and of sufficient firmness can be removed entire, and the wound closed aseptically.

In dealing with all tuberculous deposits it is of the utmost importance to be aseptic, and to make sure, antiseptic; the cases thus treated will heal readily; others will suppurate and require repeated dressings.

A peculiar phenomenon, occurring in many cases packed with iodoform gauze, is a rise of temperature on the second day; this may be the result of nerve-pressure, the irritation of a foreign body, or the effect of iodoform, we are unable to say which, but have found it does not indicate wound complication.

With an operative experience of over 20 of these cases, most of which were hospital patients, we earnestly recommend surgical measures in chronic cases, and believe that the operation in selected cases is devoid of danger.

REMOVAL OF AN INTUBATION TUBE FROM THE BRONCHUS BY TRACHEOTOMY: RECOVERY*

CHARLES H. MAYO

On July 6, 1895, I was called, in consultation, to make an immediate intubation upon H. R., a boy five years old. He had been sick four days, with an increasing croup, cough, and fever, was cyanotic, and struggling for air. The condition had been diagnosed and treated as membranous croup. The third in the series of O'Dwyer's intubation tubes (the one directed to be used in children from four to six years of age) was inserted, and complete relief of the dyspnea followed. The head of the tube rested well above the vocal cords, easy to reach with the finger. Breathing was comparatively easy, and after watching the patient half an hour, I considered it safe to leave the house. Three hours later I was hurriedly called to reinsert the tube for rapidly developing dyspnea. The tube was allowed to remain two days this time, when it was removed without difficulty; but, as before, it became necessary to reinsert it six hours later for impending suffocation. Shreds of membrane with tenacious mucus were loosened and thrown out by the manipulation of finger and tube. The tube was left, head well up, and fitting snugly in the swollen tissues of the larynx. After remaining forty-two hours this third time, it was noticeable that the breathing was more difficult and noisy. On examining with the finger I was surprised not to feel the head of the tube, and to find that the swelling and edema of the larynx and immediate structures had disappeared. Reaching further over into the esophagus, the head of the tube could be felt in the trachea, just below the vocal cords. The trachea was compressed about the tube and forced up, while the extractor was introduced into the larynx, the finger behind the larynx holding the tube forward. The difficulties will be readily understood by those accustomed to intubating. During the third attempt at extraction the tube was felt to slip down into the bronchus. Efforts at respiration became furious, cyanosis coming on rapidly, and it was evident that the tube must be removed at once. Immediate and rapid preparations for tracheotomy were made. The child's condition had grown worse, and respiration had entirely ceased just before the first incision of a low tracheotomy. The operation was pushed rapidly until the trachea was opened and caught by two artery clamps at the sides of the incision. My assistant grasped the child by the feet and held him head downward. Efforts at artificial respiration were now commenced. A probe was inserted through the incision into the left bronchus, but coming in contact with nothing metallic, it was passed into the right, where it clicked the lost tube, occasioned a slight cough, the tube slipped down to the incision, and was withdrawn. After fifteen minutes longer of forced respiration it became natural, and the child soon regained consciousness. A tracheotomy tube was procured and inserted in the wound, where it was allowed to remain six days. In spite of a septic bronchopneumonia the patient made a perfect recovery.

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*Reprinted from the "Medical Record," November 2, 1895, p. 641.

SURGERY OF THE NECK*

CHARLES H. MAYO

The careful adaptation of the incision giving free access, yet avoiding unnecessary or accidental injury, with as little disfigurement as possible, constitutes one of the differences between good and bad surgery.

Unless otherwise indicated, the curved incision following the lines of natural creases, as pointed out by Kocher, is the most satisfactory. Vertical incisions in the median line are productive of scar formation, as are incisions ending over fixed points. Therefore curved flaps, made for large exposures, are best (Chiene). The long, transverse, curved incision gives sufficient space for the removal of very large struma.

The extensive incision so frequently required for the removal of tuberculous and other forms of diseased glands involving the various triangles of the neck is best made after the "**S**" plan, which is frequently used in Senn's clinic, being preferable to the "**Z**" incision of Fenger, as the points of flap in the latter incision are more difficult of coaptation.

The margin of the long incisions should receive slight nicks at points to serve as skin marks for accurate approximation. The incision of the neck, involving the region of the platysma, should include this muscle in the flaps raised. The transverse incision for struma should sever the sternohyoid and thyroid muscles, which are again united with the deep fascia; additional space is secured by nicking the sternomastoids and freely retracting them.

In extensive gland removals we have, in many cases, severed the sternomastoid muscle completely in its center by the "step" method, and turned flaps both ways, reuniting by the catgut mattress stitch. This method was modified later by cutting only the clavicular portion or tensor of the muscle at its point of union with the sternal portion, as recommended by Fenger. This relaxes the tension and allows the muscle to be freely dissected and lifted, thus exposing the complete vessel and nerve region of the carotid and jugular. After resuture, atrophy of its lower half is less liable. The complete freeing of the sternomastoid from the deeper tissues is essential in removal of the gland-bearing fascia. The omohyoid in the lower triangle may be severed in some cases, but this is seldom necessary. The precaution of marking the ends with black silk is of advantage in its readjustment.

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*Reprinted from "Trans. Minn. State Med. Soc.," 1897, p. 133.

Large veins, such as the external and anterior jugular, are best cut between forceps or ligatures. All veins cut near their union with large venous trunks should be ligated as soon as isolated, to prevent accidental injury. A tear in the wall of a large vein may frequently be secured by a lateral ligature, thus preserving the function of the vessel.

J. B. Murphy has made extensive investigations concerning the anastomoses of large vessels by lateral and end-to-end approximation by suture, and has reported successful cases. In certain cases of extensive glandular disease in which intimate adhesions to the internal jugular are present, the application of a temporary ligature of heavy silk tied with a bow-knot to the vein and removed at the close of operation will relieve much anxiety of air embolism. After witnessing a death from air embolism, such apparent excess of care will not seem like a waste of time.

Venous hemorrhage is one of the principal difficulties in operating for the removal of large goiters; this may be readily controlled if the thyroid body is freely exposed to its true capsule, its surface rapidly separated from surrounding tissues by the fingers, and the tumor lifted out of the incision, ligating and cutting between ligatures, keeping close to the true capsule, especially beneath the tumor, thus avoiding the laryngeal nerve.

In deciding upon the amount to be removed we do not hesitate to cut through a large area of the thyroid tissue if we suture the stump with catgut. This operation loses many of its apparent dangers when we consider that, aside from its four thyroid arteries, its venous return is nearly as constant; the superior and inferior thyroid, the superior and inferior accessory, the thyroid veins on each side, and the superior and inferior communicating veins.

Cystic goiters are approached by the same method, the cyst evacuated, and its inner sac removed, similar to an adherent ovarian cyst.

The complete removal of the tongue properly belongs to surgery of the neck, and is best performed by an inverted "Y"-incision in the median line, through the soft parts, and in the inferior maxilla, its lateral arms serving for the removal of the submaxillary glands and gland-bearing fascia, also the ligation of the lingual arteries. Separation of the two halves of the lower jaw then admits of a free and bloodless dissection.

The superficial cervical nerves exposed upon lifting the platysma are guides to the posterior border of the sternomastoid muscle, winding over the posterior edge at about its middle. The spinal accessory emerges from beneath the muscle, ¾ inch above this bundle of superficial nerves, passing backward to supply the trapezius muscle. All the superficial cervicals may be sacrificed without hesitation, as well as the posterior portion of the spinal accessory, if the gland involvement is extensive.

The spinal accessory should be saved, if possible. This may be easily accomplished if isolated early, to prevent its accidental injury. I have had good results in suture of this nerve when incised. The loss of its function produces a disagreeable shoulder droop. If it is injured above its entrance into the sternomastoid, the scaleni muscle assumes its duties to good advantage. The after-results of operation in the upper anterior cervical triangle are often marred by injuring the lower branches of the facial, causing a drooping of the mouth-angle.

Injury to the hypoglossal and other deep nerves is usually the result of accident, and due to working very deep through a small external incision. Occasionally such injuries have occurred, especially in malignant growths and in cases where there has been much inflammatory exudate.

A word in reference to the removal of tuberculous glands. The idea is not to remove the enlarged glands alone, but the whole gland-bearing fascia, to obtain a cure and render subsequent operations unnecessary. The rule of Langenbeck, to free the dangerous points first, is most applicable in surgery of the neck. Make a slow dissection from the internal jugular and subclavian veins first, then use the scissors freely, lifting the whole fascia with glands intact down to the deep cervical plexus. The upper end of this tissue will be at the styloid process back of the tonsil.

In the removal of malignant disease much more extensive mutilation would be justified than in operations upon benign growths, and in such cases we should not hesitate to remove muscles, vessels, nerves, and all tissues not strictly necessary to life. The second rule of Langenbeck, to ligate the base of malignant growths early, is applicable here.

In the majority of cases we prefer to drain the wound at its most dependent portion, through a separate incision, and strive to secure complete healing of the line of incision as soon as possible. The cavities should be drained with tubular drain for two days, and spaces with folded rubber tissue for from four to six days. In septic cases we may frequently secure primary healing by inserting loose sutures of silkworm-gut and packing the wound open for two days, adjusting the sutures upon removal of the pack—the method of Billroth.

Our usual method of closure is by a few interrupted sutures of silkworm-gut dyed in logwood solution, to favor removal, tied without tension, and the careful approximation of skin suture with gauze and collodion, applying a moist antiseptic dressing over all. The subcuticular stitch is of frequent service in preventing suture scar. This method of closure will secure a large proportion of primary unions. Should suppuration occur, the frequent changing of moist boric-acid dressing under oiled paper soon secures a dry, granulating wound.

THYROID

THE SURGICAL TREATMENT OF GOITER *

CHARLES H. MAYO

The statistics of the continental surgeons in reference to goiter have added to the wholesome respect in which we hold their surgical skill. There the various operative methods affording relief have been advanced to a high state of perfection. Especially is this true in localities in which goiter is endemic, where many surgeons have done hundreds, a few over a thousand, and the great surgeon, Kocher, is well along now in his third thousand, of operations for goiter. Their mortality is low, and becomes less with increasing experience. In this country, where the disease is comparatively rare, the greater proportion of operations have been from necessity, and too often were delayed until a fatal result was a not infrequent occurrence. Few operators have had a large experience, and the mortality has been somewhat higher, taken as a whole, than that of continental surgeons; but possibly this difference is not so great for the cases of the same average severity.

There are a few points in the development, location, structure, and function of the thyroid gland which are so directly associated with the disease and symptoms produced that a brief review of the anatomy of the organ will be of advantage. The thyroid gland consists of three parts—two lateral lobes and an isthmus. Each lateral lobe is about 2 inches long and pointed at the upper end. The isthmus unites their lower inner portions across the trachea, covering from the first to the fourth tracheal rings. The whole gland weighs from 1 to 1½ ounces. In the development of the thyroid gland the inversion takes place from the pharynx, the

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* Read before the Thirteenth Annual meeting of the Western Surg. and Gyn. Assoc., December 28, 1903. Reprinted from the "Jour. Amer. Med. Assoc.," April 23, 1904.

superior inversion being at the back of the tongue; and the remains of the nearly closed duct is known as the foramen cæcum, while the remainder of the duct usually becomes atrophied to a cord extending through the tongue toward the hyoid bone. In 43 per cent. of cases a so-called middle or pyramidal lobe is present, extending from the upper border of the isthmus toward the hyoid bone. It is in these lines of inversion that the accessory thyroids are more often found, a condition which has been thoroughly described by Bernays. The gland consists of a number of alveoli of small size and various shapes. It is covered by a delicate connective-tissue capsule, in and beneath which, upon the surface of the gland, is the venous plexus. Penetrating the gland in all directions from the capsule are delicate connective-tissue layers which form and support the alveoli, and in which are located the lymphatic vessels of the gland. The superior thyroid artery from the external carotid supplies the upper horn, entering the capsule at its apex, and anastomosing freely with the vessels of the opposite side and the inferior thyroid artery below. The latter vessel arises from the thyroid axis, and enters the gland on its inner inferior surface next the trachea, at a point called the hilus. At this point the vessel and gland are in close relation to the recurrent laryngeal nerve, and it is in the ligation of this artery next to the gland that this nerve is so frequently injured. There is occasionally another artery found, called the thyroidea ima; arising from the aorta or innominate artery, it ascends upon the trachea and enters the isthmus. The veins are the superior and lateral, which enter the internal jugular, and the inferior, which is usually quite large, arising from the venous plexus of the capsule, and from either side they usually unite to enter the left innominate vein.

In disease of the gland the number of veins may be somewhat increased, but the location is nearly constant. The capsule is extremely thin, but behind it divides into two layers, one inclosing the gland, the other passing behind the pharynx and esophagus. A firm band of connective tissue is also attached on each side of the cricoid cartilage, and becomes blended with the capsule to act as a sling support. This peculiar formation of the capsule explains the dyspnea, from lateral pressure of the trachea, often complained of in enlargement, and also why even large tumors are firmly held to the trachea. In certain types of goiter this capsule become greatly thickened. Dysphagia may occasionally be present, and at times dysphonia. The nerves are derived from the middle and inferior cervical ganglion of the sympathetic, as well as the inferior and the external laryngeal nerves. The gland has no duct, but is well supplied with lymphatics, which Baber has shown are filled with the same semiviscid, colloid secretion found in the alveoli of the gland, and it is probable that they act as ducts in carrying the secretion to the circulation by way of the tracheal and cervical glands. This theory of the lymphatic system, acting as the carrier of secretion from the ductless glands to the circulation, aids in explaining the etiology of various tumors and retention cysts from their inactivity, as well as thyroidism from oversecretion and absorption. These lymph-glands, as well as those of the mediastinum, are early involved in malignant disease of this organ, and contribute largely in rendering operations for the relief of such diseases only palliative or worse.

The function of the thyroid is a question still under discussion. We know that children born without a thyroid and those who lose them early by operation or atrophy develop a condition known as cretinism; that those in adult life who in any way lose the function of the gland develop myxedema. Tetany may also develop from arrested function—well-known conditions which it is unnecessary to describe at this time. We know that an excess of activity of the thyroid function develops a condition known as exophthalmic goiter, Graves' disease, or Basedow's disease. The symptoms of these are characterized by rapid pulse, goiter, protrusion of the eyeballs, retraction of the upper lid, muscle tremor, and nervous symptoms. The main symptoms are the tachycardia and muscle tremor, other symptoms and the prominence of any depending upon the patient and the stage of the disease. The various changes in the thyroid, aside from malignant, tuberculous, syphilitic, or hydatid diseases, are such as might be expected from its structure, namely, atrophy, hypertrophy, cysts, adenomata, fibroid or calcareous degeneration, and parenchymatous enlargements. The more common form is the latter enlargement, which is the type of uniform tumor seen in young people. It appears at about the age of sexual activity, and is characterized by an increase in the size and contents of the alveoli. In these cases there is also an increase in the solid elements of the gland. This type of goiter frequently, and we may say usually, responds to medical treatment. In many instances the colloid material is so abundant and the alveoli so large in the long-standing parenchymatous goiters that they are called colloid cystic goiters, and it often occurs that several of the various types may be represented in one tumor.

The conditions which have rendered operation imperative have usually been dyspnea, from compression of the trachea or its displacement, and from retrosternal enlargements. Dysphonia and dysphagia have been important symptoms at times, and in many instances the weight and general nuisance of a large tumor, as well as cosmetic reasons.

Acute infections often demand surgical intervention. More recently the symptoms of Graves' disease have placed exophthalmic goiter in this domain of surgery—whether properly or not is a matter still under discussion.

In an analysis of 3408 cases Réverdin placed the mortality from total extirpation at 19 per cent.; from partial extirpation, at 3.5 per cent.; from intraglandular enucleation, at 0.78 per cent.; from resection, at 6.6 per cent. Such statistics are but relative, however, as it is probable that the total extirpations were demanded for serious conditions, and the intraglandular enucleations were presumably for the encapsulated adenomata. The deaths, when immediate, are from hemorrhage, air-embolism, myocarditis, suffocation, or the anesthetic. Later deaths are usually from pneumonia, from sepsis, tetany, or myxedema.

Of the various methods of attacking thyroid enlargements, Mikulicz has developed the resection of a part of one or both lobes after ligating or compressing the arteries. Ostermayer crushes off a part of the gland and applies mass ligatures. Socin has developed the intraglandular enucleation. Kocher advanced the method of incision of cysts and shelling out their contents, and also the popularized common method of lateral extirpation in its capsule, dividing the isthmus and leaving a portion of the capsule at the side of the trachea to protect the recurrent laryngeal nerve, which he injured more or less in 7 per cent. of his first thousand cases. Paucet and Billroth made massive enucleation within the capsule.

Cysts have been treated by puncture, injection, and drainage, but are now usually enucleated. Injections of various solutions into goiters are generally considered nearly as dangerous as radical operative measures, and, curiously enough, are more often employed by the internist than by the surgeon, who always doubts the true position of the point of an instrument as soon as it is out of sight.

The displacement of a goiter by open incision, allowing it to granulate in the open wound, or exothyropexy, is seldom practised. Incision of the isthmus for tracheal compression is sometimes employed as a temporary measure, but, as a rule, the relief is slow to manifest itself, and the symptoms recur early. Ligation of three or four of the thyroid arteries is nearly as serious an operation as the removal of part of the gland. These cases seem to be exposed to all the risks, both primary and secondary, as if the gland were attacked directly. The removal of a part of the cervical sympathetic ganglion for the relief of exophthalmic goiter, as advocated by Edwards and popularized by Jonnesco, has had a fair degree of success. It is barely possible that the destruction of the lymphatic ducts efferent from the thyroid may account for some of the improvement noted. This hypothesis will also explain the favorable reports following the exposure of exophthalmic goiter to the x-ray.

During the past fifteen years we have observed a large number of parenchymatous goiters which have been successfully treated, usually by some combined internal and external method. In the same period 110 patients have been subjected to operation for the relief of some type of thyroid tumor. Of these, 34 were for exophthalmic goiter, with 6 deaths. Two were for carcinoma of the thyroid, with 1 death on the third day from sudden collapsing of the trachea. The other, whose trachea was involved, required the permanent use of a long cannula tracheal tube until death occurred, fourteen months later. One case was a large lingual thyroid; 2 cases presented enlargements of the pyramidal lobe only, and these tumors were apparently separate from the remainder of the gland. The other cases, numbering 71, with 1 death from pneumonia on the eighth day, presented the various types of adenoma and colloid cystic goiters. In 2 cases there were large areas of calcareous degeneration. One case was a large cyst with 16 ounces of fluid, and apparently involved the entire gland. Two colloid cystic goiters were very large, one measuring 22, the other 19, inches across the tumor from one side of the neck to the other, and resting upon the sternum. In 3 cases the entire gland was apparently removed, but as this operation was by the enucleation method, we considered it probable that there was some active gland tissue within the capsule or an accessory gland present, as there were no symptoms developed which could be attributed to the loss of the gland.

We prefer the Kocher collar incision as giving the most exposure and causing the least scar. This incision crosses the gland in the line of the creases of the neck, and extends on one or possibly both sides as far as the posterior border of the sternomastoid muscle. In special cases more space is gained by splitting the lower flap in the center down to the upper border of the sternum. The sternohyoid and thyroid muscles can at times be retracted sufficiently to deliver the tumor or portion of the gland to be removed; but if they add any difficulties to the operation, we have no hesitation in cutting a part or all of them and reuniting them by suture during the later steps of the operation. There is often some difficulty in determining which is the true capsule, and the incision can be deepened into the tumor until gland tissue or tumor tissue is exposed; the hemorrhage is inconsiderable if the larger vessels are avoided. Inspection of the tumor after its free exposure will indicate the best method of procedure in the operative technic of its removal. If the capsule is thick and nearly the whole gland has disappeared into one rounded mass, we prefer the enucleation method of Socin, as in case of cysts they can be evacuated and the cyst-wall removed, and if adenomata or large colloid cysts, it is possible that enough gland material will be left to functionate should it be necessary to remove the whole mass. If, as is more often the case, the tumor, upon exposure, retains the general normal contour of the gland, we extirpate one lobe, usually the right, after the method of Kocher. In case of retrosternal enlargements it is delivered with this lobe if possible. The veins leaving the true capsule laterally are divided, and the upper horn dislocated sufficiently to doubly ligate the superior thyroid artery and vein. The tumor is further dislocated and freed from below with dry gauze dissection until the inferior thyroid artery and veins can be ligated. The isthmus is now crushed with large forceps, and ligated or closed by sutures after severing the tumor. If there is any difficulty in raising the lobe from the trachea and region of the recurrent laryngeal nerve, the capsule is incised under the lateral border and allowed to remain, the gland being cleansed from its surface. The wound is now closed by a subcuticular suture, and usually free drainage is employed by separate incision or by the vertical median incision above the sternum.

Exophthalmic goiters are extirpated in the same manner, using greater care to avoid undue force or compression of the gland in its removal. Our usual rule is to give a hypodermic injection of 1/6 to 1/4 grain of morphin about twenty minutes before operation, as it quiets the general nervousness and aids anesthesia. Unless there is extreme dyspnea or extremely marked exophthalmic symptoms, we prefer the drop method of ether anesthesia. In such cases we employ the cutaneous injection of cocain. This method is also used if we lack confidence in the anesthetist. The after-results have been perfect in colloid and adenomatous goiters, with the exception of one case of permanent hoarseness, and a few with this feature lasting but a short time. In operating for malignant disease we found the usual rule to hold good, that the operations were delayed, difficult, palliation short, and mortality high.

The exophthalmic cases which recovered from the operation were all benefited within a period of three months; about 50 per cent. became free from exophthalmic symptoms within from three to six months following the operation. In 25 per cent. the improvement was continuous during a year. In 25 per cent. the improvement was partial, the exophthalmos being slow to disappear. None who lived were made worse, and those who died were the most severe types of Graves' disease, especially presenting tachycardia of from 130 to 150. Following the operations upon the thyroid gland, a condition of acute thyroidism may occur during the first twenty-four to forty-eight hours. To a great extent this depends upon the amount of traumatism in the operation. The condition is more noticeable in the exophthalmic cases, and it is usually accompanied with from one to four degrees of temperature.

THYROIDECTOMY FOR EXOPHTHALMIC GOITER, BASED UPON 40 OPERATED CASES*

CHARLES H. MAYO

These patients present themselves to the physician for the relief of symptoms which he attributes to exophthalmic goiter, or they come to have a confirmation of diagnosis, and to obtain relief if possible. There are many symptoms common to Graves' disease, more or less of which may be present. The one symptom most common to all cases is tachycardia, and with this are usually associated the goiter and the prominent eye, which are so characteristic of the condition. From their late or non-appearance these two symptoms have often delayed an early diagnosis of the disease.

A not uncommon type is one in which the symptoms of Graves' disease are suddenly grafted upon a patient who has had colloid cystic goiter for some years. It is also true that patients without, as well as with, goiter seem at times to develop many of the symptoms of exophthalmic goiter, and yet they recover very soon, often without any special treatment.

We must assume that there may be a combination of causes for exophthalmic goiter, accepting as the major cause the gastro-intestinal toxemia of certain medical writers as a part with the thyroid element, and the nerve theories as not least in the combination of circumstances.

To read the medical side of this question it would seem that the internist and surgeon are gradually drifting apart. The internist attempts to convict the surgeon with his reports of multiplicity of operation, large mortality, and the not infrequent failures, and he lauds the medical, hygienic, and diathetic treatment. Judging from personal knowledge, it is probable that most of these cases who finally see the surgeon have already run the gantlet of all known remedies for the disease, and usually at the hands of several practitioners. It would be rare, indeed, for a surgeon who was capable of making an operation for the relief of this condition to recommend operation at the inception of an attack of Graves' disease, unless it were possibly a case grafted upon an already goitrous patient.

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*Read before the Amer. Surg. Assoc., 1904. Reprinted from "Trans. Amer. Med. and Surg. Assoc.," November 5, 1904.

Practically all surgeons have passed years in general practice, and have seen the ordinary exophthalmic patients improve under medical treatment, electric treatment, no treatment, and the mental suggestion of Christian Science. We all know that some cases resist all efforts at relief. What shall be done for them?

From the experiments in blood-pressure, shock, and resuscitation carried out by Crile, it would seem that the blood-pressure is maintained by the vasomotor system as a direct nerve type, and by the internal secretions as a blood type, acting upon the vessels even when the head is removed. From the limited knowledge we now possess of the internal secretions, this equilibrium of the blood-pressure must be in great part sustained by the opposing action of the secretion of thyroid and suprarenal glands. One of the functions of the suprarenal gland secretion serves greatly to increase blood-pressure, and through its action upon the capillaries it greatly reduces all peripheral circulation. While a tension is occasionally noticed in the pulse of Graves' disease, it is more often low, especially when the disease is active.

Were it possible that these secretions in effect served to maintain an equilibrium of certain blood elements, it would readily explain the effects of an excess of thyroid in one case and an excess of suprarenal in another. Thus the loss or absence of thyroid tissue in the young is followed by cretinism from the unobstructed action of the suprarenal glands, contracting all peripheral capillaries and preventing growth and development. In adult life the same conditions cause intellectual degeneration and myxedema. While it is contended that the thyroid secretion does not, when given to the system, cause Graves' disease, it is certain that some of the prominent symptoms may be thus produced. We must admit also that the thyroid secretion employed is changed, and given in an abnormal manner as compared with the constant delivery of the internal secretions by means of the lymphatic system acting in great part as ducts. The hard and practically dry gland of this disease, as compared with the juicy colloid cystic variety, would indicate unusual activity, as well as delivery of the contents of the acini, while in the colloid goiter the secretion may be retained, at least in part; and even in cases without goiter a careful examination usually discloses a small unilateral or bilateral tumor, which lies deeper but is firmer than normal.

What has been done surgically for this condition? First, exothyropexy. This operation is now rarely performed. Second, ligation of the thyroid arteries. Third, operations upon the cervical sympathetic ganglia, after the suggestion of Edwards, and developed by the work of Jaboulay and Jonnesco, for the relief of several diseases. Fourth, thyroidectomy, which we will discuss later. Fifth, the apparent psychologic effect of operations upon distant parts of the body will not be considered.

It has been our fortune or misfortune to operate upon several cases of cervical adenitis which had been exposed to the x-ray many times. It was noted that the lymph system was greatly sclerosed. As this was in line with the reported action of the x-rays upon glandular activity, we have applied this treatment to 10 cases of very marked exophthalmic goiter during the past year, first to reduce glandular activity, and, second, to reduce absorption by its possible effect upon the lymphatics. While I would not yet say that any of these cases are cured, they certainly have been markedly benefited: first, in the general nervousness; second, in tremor of the muscles; third, in tachycardia, and fourth, in the exophthalmos. The benefit is sufficient to entitle this method to a place in the treatment of Graves' disease or at least to make it a preparatory treatment to a prospective surgical method at a later period.

The symptoms in these cases were well developed; all improved.

The three cases presenting the most marked symptoms had been under observation from one to two years. At the beginning of *x*-ray treatment they improved materially, but reached a stationary condition under medical treatment and rest. All three had marked exophthalmos, choreiform jerking, and a pulse of from 120 to 140. The choreiform jerking disappeared; exophthalmos diminished markedly in one, improved in one, and almost disappeared in the third. Pulse (patient at rest), 68 to 70 in one, 75 to 85 in one, and 90 to 98 in one. Circumference of the neck taken around the most prominent part of the goiter diminished from ½ to 1¼ inches. One lost 15 pounds, 1 gained 10 pounds, and 1 gained 49 pounds. Two cases of well-developed symptoms, but no exophthalmos, so far recovered that a diagnosis would be impossible at the present time. We still have confidence in belladonna in improving the tachycardia and nervous symptoms preparatory to operation in certain cases of doubtful operative risk.

Curtis' report of Kocher's operative cases in this line gives 29 cases of ligation of the thyroid vessels with 1 death, and 38 of partial thyroidectomy with 3 deaths. Our experience is from 128 operations upon the thyroid gland, with 8 deaths; of these, 1 followed the removal of a cancerous thyroid from collapse of the trachea, 1 from pneumonia in colloid goiter, and the other 6 deaths were in the exophthalmic cases, of which there were 40. Two of these deaths were of patients who should not have been operated upon, as their condition was so aggravated as to almost class them as moribund, one dying upon the table. All had received prolonged medical treatment. During the past year 2 such cases have been seen with regard to the advisability of operation, but, with a knowledge born of bitter experience, both were refused. One died in a week, the other lived a few weeks, but both deaths were medical. In the last 25 cases operated for exophthalmic goiter there were but 2 deaths. The shortest duration of the disease was five months, and the longest several years.

The anesthetics have been cocain, chloroform, and ether, preceded twenty minutes by ⅙ grain of morphin hypodermically.

Ten cases were completed under cocain infiltration; 2 cases required, in addition, chloroform before completion. We choose cocain for some of the worst types of nervous cases, especially with a rapidly fluctuating or irregular pulse, but can see no difference in the character or degree of shock or thyroidism in local or general anesthesia. Cocain should be used if one lacks confidence in the anesthetist. Our preference is given to ether. During the anesthesia, should much mucus accumulate in the trachea and bronchi, the patient is allowed to come out of the anesthetic sufficiently to clear the throat, and the chloroform is substituted. The Kocher collar incision is used, and a complete exposure of the gland made, cutting everything which impedes access to it. One-half of the gland, and possibly the isthmus, is taken.

According to Sifton, the right recurrent laryngeal nerve closely approaches or is in contact with the right inferior thyroid artery, while on the left it is over ¼ inch back, and an effort would be required to injure the nerve upon that side. The method of removal by extirpation is the rule, as in these cases there is usually very little capsule, and enucleation is out of the question. What can be left of the posterior capsule is a great protection, especially upon the right side, for the reasons stated above.

Thyroidism of some degree is common. It is not from rough handling of the unbroken tumor and forcing secretion into the veins. If so, it would be equivalent to hypodermic injection into a vein, with immediate effect, when in reality it comes after some hours, and is due, apparently, to absorption of the wound serum, with some thyroid secretion in suspension. Thus many of the symptoms of Graves' disease are not uncommon for the first few days following the removal of ordinary colloid cystic goiter. For this reason we drain exophthalmic goiter wounds as freely as we would a septic process. If there is anything which increases absorption in wound or gland, it is loss of blood. Therefore, if the patient unavoidably lose a quantity of blood, every effort should be made to replace early the quantity lost, or more, by salt solution. This is true also of operations upon exophthalmic patients who are operated upon for other necessary surgical conditions. We have had one patient afflicted with Graves' disease die four days after the removal of a twisted pedicle ovarian cyst, with all the characteristics of a death following the removal of the goiter, except the delay for two days of the severe symptoms.

For the relief of thyroidectomy and increased tachycardia suprarenal extract has a marked effect, but seems to be somewhat difficult of permanent control. The benefit obtained from atropin and morphin is often very satisfactory.

I do not wish to be understood as objecting to operations upon the cervical sympathetic, as it is very certain that good results are thus obtained; still, such operations have considerable mortality, and the same disagreeable symptoms often following extirpation. We have, therefore, chosen to work directly upon the organ affected in operating for the relief of this condition. Could we eliminate more of the hopeless and yet operate upon medium and severe types of Graves' disease, the results of thyroidectomy would justify the operation and compare favorably with those obtained by other methods.

Our own cases show marked improvement of all who survived the operation. Of these, 50 per cent. made a very early recovery-especially of the severe symptoms,—tachycardia, nervousness, and tremor,—25 per cent. did so after several months, and 25 per cent. were improved, yet suffer from irregular recurrence of some of the major symptoms.

The improvement noted was first a relief from nervousness, the irregular twitching and jerking, not unlike chorea, next the tachycardia and the tremor, while the exophthalmos, if at all marked, seemed to disappear last.

Our rules concerning the cases of Graves' disease which come to us for operation are to operate if their condition is fair, but if the pulse is from 130 to 160, if it suddenly fluctuates in tension and rapidity, if there is anemia with swelling of the feet, the patients are placed upon the belladonna treatment for some days. The more severe types are also given *x*-ray exposure, which is continued from two to six weeks.

Of the 6 deaths in our series, one occurred upon the table as the final skin sutures were being placed; two occurred from fifteen to eighteen hours after operation, and 3 occurred from twenty-four to seventy-two hours after operation. They suffered from an exaggeration of the previous symptoms: the jerking, tremor, increasing rapidity of pulse, and exophthalmos. As pointed out by Fenger, the degeneration of the heart muscle will account for some of the sudden deaths, while the absorption of thyroid, shock, anemia, and general nerve exhaustion will account for most of the other deaths which are not due to the anesthetic.

SURGICAL TREATMENT OF GOITER, BASED UPON 200 OPERATIONS *

CHARLES H. MAYO

As a field for specialism in surgery, the neck offers many inducements to surgeons who would limit their territory. Among the numerous diseases of this region, none present more varied or interesting phases than those of the thyroid gland. It is subject to anomalies of development, hypertrophies, tumor growths, and inflammations, as well as changes in both the quantity and character of its secretion. Formed as it is, from median and lateral inversions of the pharyngeal hypoblast, it becomes subject to the same failures of development as occur from defects in closure of branchial clefts. Portions of the gland fail to unite; lost or accessory particles or portions of gland are found detached in developmental areas.

The superior point of inversion is at the foramen cæcum in the tongue. This portion forms the upper poles and also the upper portion of the isthmus. In less than one-half of people it leaves a tongue of gland above the isthmus, called the pyramidal lobe. In this area accessory thyroid growths are not uncommon, from detached or fetal particles undergoing excess of development from loss of normal nerve control. Such growths may also occur in the tongue. The greater portion of the lateral lobes is formed from lateral inversions from the pharynx, one or both of which may be missing or may not unite with the isthmus, as occurs in most of the vertebrates. In these regions accessory lobes are also found.

The gland somewhat resembles a horseshoe—two lobes, one on either side of the trachea, connected across its upper ring by the

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*Read before the Medical Society of the Missouri Valley at St. Joseph, Mo. March 23, 1906. Reprinted from the "Medical Herald," May, 1906.

isthmus. They are about 2 inches long, being smaller at the upper portion. Its weight is from 1 to 1½ ounces. A thin fibrous capsule invests the entire gland, a portion of which passes separately behind both the esophagus and the trachea, to connect with the opposite side. To this structure are due many of the symptoms of pressure which occur in tumors inclosed by a dense capsule, the growth within which interferes with swallowing, breathing, or speaking. Firm fibrous bands also unite the gland to the trachea and cartilages, which causes it to move with these structures. Trabeculæ of connective tissue pass into the gland and break up into minute subdivisions, which inclose the acini and constitute the supporting structure of the organ, as well as forming a space for the lymph-channels, which in all probability act as the ducts for a portion of its secretion. The blood-supply of the thyroid is remarkably extensive for an organ of its size. The vessel anastomosis is very free. The external carotids through the superior thyroid arteries supply the upper poles, while the inferior thyroids from the thyroid axis on each side supply more directly the larger part of the gland. The main veins are the superior, middle, and the inferior, although others seem to develop in diseased organs. The nerve-supply is from the sympathetic. In intimate relation with the right inferior thyroid artery is the recurrent laryngeal nerve, which lies in the space between the trachea and the esophagus, and is often so affected by pressure of tumors, by operation, or scar tissue as to cause hoarseness. On the left side the recurrent is usually more deeply set, and not in such close relation to the artery, as was pointed out by Sifton.

Associated in function, but less understood, are the parathyroids, four small glands, two on either side of the neck, behind or within the investing gland capsule. These glands are seldom seen in the surgical work upon the thyroid or adjacent structures, unless they are themselves enlarged by disease. It is claimed by Humphrey that a fatty degeneration of these bodies exists in Graves' disease.

In the review of foreign literature by Willard Bartlett he stated that Pineles noted that tetany could not be produced by complete removal of the thyroid glands as long as the parathyroids were left behind, but if the parathyroids were removed, tetany was caused without cachexia. The experiments were made upon cats and dogs.

Pineles explains the occurrence of tetany in the human by the fact that in operations removing both lower poles the small glands were often removed, even if the upper segments were left.

Kocher reports 70 per cent. of cachexias in 34 cases of total excision. Garré reports 50 per cent. in 67 cases. Billroth had 52 cases develop tetany with 9 deaths, and 11 developed cachexia. The London Myxedema Committee made a more favorable report, finding only 24 per cent. in 224 cases of total excision.

It is probable that only the more marked cases are reported, as it is common that partial cases are overlooked when brought about by disease of the gland, and the activity of accessory thyroids is always an unknown possibility.

The loss or lack of function of the thyroid gland in the very young prevents mental and physical development; its loss in the young adult induces mental deterioration, while in the adult the frequency with which myxedema follows total removal and the known effects of oversecretion all favor the wholesome respect which physiologists and surgeons hold for this organ.

In Graves' disease the older impressions are still in circulation. Some insist that exophthalmos must be present; others that a goiter is essential. If medical, the case is treated as a case of exophthalmic goiter. Should a surgeon operate, removing the larger half and isthmus of the gland, and the pathologic report be colloid with hypertrophic areas, some authorities would say that it was a case of pseudo-Graves' disease, their experience being derived from the medical treatment of such cases, without removal of gland tissue for examination. This type of case is not rare, and often presents the most exaggerated symptoms of Basedow. The fact is that, like degrees of myxedema from loss of function, we have degrees of Basedow's from excess, and while the essential feature of the pathology of these cases is hypertrophy, it may be, and often is, general throughout the gland. It also may be only in a few or many local areas mixed with other types of changes in structure.

The goiters usually found in young people from eighteen to twenty-five are the so-called simple goiter, a parenchymatous enlargement with excess of colloid. They usually recover with or without treatment. Teratoma and echinococcus are uncommon, but must be considered. Irregular enlargements may be adenomata, cysts, or unevenly developed colloid goiter.

Malignant disease in the thyroid also occurs in irregular enlargements, and is often accompanied by voice changes. Bloodgood states that when a differential diagnosis is possible, it is probably too advanced to cure by operation. Sarcomata may be more uniform in growth and cystic. Most of the bulging tumors evenly rounded, covering the front of the neck and moving with the trachea, are cystic, or colloid cystic, with a heavy capsule in which may be a thinned-out layer of the remains of the gland. The removal by enucleation of such masses and saving the capsule merely eliminate what the system has already accustomed itself to do without, and usually creates no more disturbance of the economy of the body than the removal of a blind eye, dead kidney, or cystic gall-bladder.

Many operations made upon enlarged thyroids are necessary to relieve pressure and associated symptoms. Others, however, are purely a question of expediency, to relieve an unsightly tumor which is the source merely of more or less discomfort.

Operating upon exophthalmic goiter is often a life-saving procedure. The surgeon cannot always secure consent to operate before delay renders the patient's condition so nearly moribund that the shock of operation induces a mortality prohibitively high.

We will not consider the semi-surgical treatment of goiter, injection, puncture, and drainage methods, as they are nearly as dangerous as radical operative methods, and must be reserved for special indications. The same may be said of Jaboulay's method of exothyreopexy.

In Graves' disease the operations upon the sympathetic ganglia, advocated by Abadie and Edwards, and developed by Jonnesco and Jaboulay, are not so satisfactory in permanency of results as well-directed operations upon the gland itself. Rehn's report makes it less than half as favorable. Serum treatment has not been sufficiently worked out for us to experiment with the numerous samples on the market.

In cases of very severe types of Graves' disease it may be necessary at times to prepare patients and keep them under observation, better to estimate their ability to withstand operation. The condition of the heart seems to be the most important in these cases. As a rule, an effort should be made to reduce the pulse to 120.

At times cases can be operated with safety who have a pulse of 140 or greater, but the risk increases if the pulse fluctuates greatly in tension and rapidity from slight exertion or nervousness. Such cases should be prepared for operation for possibly a number of weeks before it can be attempted with safety. For the purpose of improving their condition we give extract of belladonna in 1/6-grain doses three or four times a day for its general effect, and to inhibit glandular activity. If there is not considerable improvement within six weeks, *x*-ray exposures are added to the degree of local tolerance. The rays have almost a selective action upon glandular tissue, and often seem to exert a favorable effect in these cases.

After operation the improvement in cases of Basedow's disease is most remarkable and early. Within two or three days, as a rule, there is a reduction of the tachycardia and the nervousness is under control. Often the prominent eyes are greatly improved in a few days, but in the worst cases this symptom is slow to disappear completely.

If there is not a large tumor, we content ourselves with the removal of one-half the gland with the isthmus. This may also be done if the tumor is larger, but in such cases, where the remaining half increases and the symptoms relapse, a further operation to remove the lower half of the remaining lobe is indicated.

In cases of very severe Basedow's, with medium or large goiter, it is best to remove one lobe,—usually the right,—the isthmus, and the lower half of the left, leaving the lateral vein and the upper pole with its vessels.

We should plan to leave about as much as would constitute a normal thyroid in quantity; that is, from 1 to 1½ ounces of gland.

Of all goiters, the simplest and safest type of case for operation is where the tumor is rounded and more or less even in contour. If it is firm, it is so much the better, as it has a strong capsule. These tumors are of a cystic nature, and occur in one or both sides or the center; at times they seem, from external examination, to have taken the place of the entire gland. After exposure, the outer capsule is incised and the operator at once comes upon either the cyst-wall or gland tissue; if the latter, penetration into it will quickly expose the sac of the cyst, and enucleation can be made. In large simple cysts it often occurs that only a small amount of thyroid is left in the capsule, which is saved by this method of operating. The cases with irregular growths can be treated by extirpation of one side—the larger—and enucleation of cystic masses in the remaining portion. The dangers from operation in these cases are, as a rule, not great unless the condition is an exceptional one, complicated by absorption of tracheal rings and collapse of its lumen, retrosternal growths, enormous size of tumor, venous distention, or some local or general condition from which the patient suffers in addition to the goiter.

The last fifty years has seen the mortality following these surgical operations reduced from 40 per cent. to 1 or 2, Kocher's later percentage in uncomplicated cases being 0.2 per cent.

The causes of death are anesthetic, shock, hemorrhage, air embolism, pneumonia, suffocation, acute thyroidism, and infection. It is not common to have injury of the recurrent laryngeal nerve, although it is difficult to prevent it in certain cases in which the posterior capsule does not readily separate from the gland. In goiters in which there is a general enlargement it is a rule that the remaining half shrinks after removal of one-half and the isthmus. Bergeat reports only 2 per cent. of recurrence in several hundred cases investigated.

If there is any one thing connected with surgery which is unstable, it is anesthetics. Hardly a journal but gives every few weeks some new method of producing anesthesia. Men without great experience with any anesthetic often take it upon themselves to recommend changes. It is probable that the great varieties of methods are developed because of the idiosyncrasy of the operator, rather than the necessities of the patient. In some 13 cases we have used cocain infiltration. In 3 of these the operation was completed under chloroform. In the last 150 cases we have operated under ether, preceded twenty minutes by a hypodermic of $\frac{1}{6}$ grain of morphin and $\frac{1}{120}$ of atropin. We have had no deaths which we could attribute to the anesthetic.

Operation.—We prefer the transverse collar incision. This is made across the neck, from the inner border of one external jugular to the other, even though the tumor be unilateral. The incision includes the skin and platysma myoides, and is convex on its lower border, accurately to follow the skin lines of the neck, and it is usually over the center of the tumor. The wound is enlarged by dissection of these flaps from above and below to the thyroid cartilage and sternum, narrowing in width of dissection top and bottom to the sternothyroid muscles and the sternum. The sternothyroid muscles, usually free below, are separated above by a vertical incision. The group of muscles on either side comprising the sternohyoid, sternothyroid, and omothyroid are now separate from the loose cellular capsule of the thyroid gland and forcibly retracted. In this way sufficient space is secured for the removal of moderate sized tumors.

In case that more room is required for large goiters and for certain types of goiter, such as in Basedow's, it is secured by incising one set and very rarely both sets of muscles covering the tumor. This muscle division is usually wrongly made over the bulging part of the gland in the line of skin incision, but should be made as high as the thyroid cartilage. Lateral retraction folds the muscles over the inner border of the sternomastoid. Partial section may be sufficient to furnish ample space. The most important part of this high section of muscles is that it preserves the nerve-supply to these structures, the thyrohyoid muscle being supplied by a branch from the hypoglossal and others by the loop of communication between the descendens and communicans of the hypoglossal. It also exposes the key of the situation—the superior thyroid artery.

In very large tumors it may be necessary to secure still more room. This is done by splitting the lower flap of skin and platysma in the center of the sternal notch, which actually exposes the whole field of operation. Such a dissection exposes all the area of the thyroid gland, and should be employed especially by operators unaccustomed to this work. After the extirpation of the tumor the muscles are united by sutures, but as this is 1½ to 2½ inches above the line of skin closure, the scar is broken and the skin does not become attached to and move with the upper muscle stump, as is so commonly seen. If it is desired to remove one-half the thyroid, the superior thyroid artery is first ligated at the upper horn, which is then elevated and the posterior capsule opened and brushed to the midline. As the tumor is lifted, the one or two lateral veins are doubly clamped and ligated. The capsule is still further wiped inward and the lower lobe lifted, the inferior thyroid being clamped on a level with or above the capsule. Leaving the posterior capsule aids in saving the parathyroids. The isthmus is separated, clamped, and cut.

Several dozen clamps are necessary at times, especially in exophthalmic cases, as the smaller vessels in these patients, from the thyroidism present, bleed like leech-bites.

In the hard, rounded tumors the outer capsule should be penetrated to the shining capsule of the tumor within, which can often be enucleated. These are very safe cases for operative recovery. In the worst types of exophthalmic cases, after removing one-half, which is usually the right and the isthmus, the lower pole of the left side is elevated and the inferior thyroid ligated. An incision is then carried obliquely across this half of the gland from the isthmus to a point below the lateral vein. The lower part is removed. Mattress sutures are used to stop bleeding. The removal of this part of the gland will cause more hemorrhage than the removal of the other lobe and isthmus, but will be found to be worth while in both the immediate as well as the later results. The wound is washed with Harrington's solution No. 9 before closing, in those cases which are to be drained; that is, in those cases in which the traumatic area will induce considerable wound secretion, and because of the toxic nature of the secretion.

The use of slowly given large saline enemata by rectum seems to delay absorption in the exophthalmic cases, and restores fluid to the circulation in all in which the operation is attended by considerable loss of blood.

These operations for goiter secure most surprisingly early results, the very worst case often being able to leave the hospital in six days.

Mortality.—In a total of over 200 operations we have had but one death, if we exclude exophthalmic goiters and malignancy. This fatality was from pneumonia on the eighth day.

SURGICAL TREATMENT OF GOITER, BASED UPON 300 OPERATIONS*

CHARLES H. MAYO

Until recently the medical profession of America has been somewhat backward in advocating the surgical treatment of goiter. More especially has this been true regarding that type of goiter known as Graves' or Basedow's disease. The great majority of patients operated on for goiter, other than the exophthalmic form, do so to be relieved of a great nuisance, which may be causing tracheal irritation or pressure, impairment of the voice, difficulty in swallowing, or local neuralgia. Often, too, the weight, size, and appearance of the large tumors urge patients to operation. There is also the fear, not unfounded, of later malignancy of the growth.

Among the 300 operations, and a large number of cases seen but not operated upon, nearly every disease common to this organ was found except teratoma, tuberculosis, and hydatid. There were 110 operations for exophthalmic goiter, with 9 deaths, 4 of which occurred in the first 16; 3 in the next 30, and 2 in the last 64. Only 5 cases of hyperthyroidism were seen in men. Of malignant diseases, 2 sarcomata and 6 carcinomata were operated upon. Following the removal of carcinoma, there was 1 death on the third day from collapse of the trachea. Of the other 190 cases, there was but 1 fatality, and this occurred on the eighth day from pneumonia in a patient who had a large colloid goiter. Two cases suffered from acute hemorrhages into previously existing goiters. Excluding those cases presenting hyperthyroidism, colloids represented 54.5 per cent.; adenoma, 30 per cent.; and cysts, 5 per cent.; 4.2 per cent. were malignant, and 2 per cent. were fetal adenomata.

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*Reprinted from "Southern Surg. and Gyn. Trans.," vol. xix pp. 32–39.

Many colloid and adenomatous goiters were in various stages of transformation. Irritative conditions had developed calcareous deposits in a few colloids of long standing. The glands removed for hyperthyroidism presented hypertrophic changes in cells and loss of colloid substance. In those who had developed Basedow's disease upon preëxisting goiter the glands showed areas of hypertrophy intermixed with colloid areas.

The simple goiters appearing in girls at puberty and during the early years of menstrual life are not operated upon unless they change later to other types of tumors.

Preparation of the Patient.—The condition of the patient has much to do with the outcome of the surgical treatment. The urgency of an operation for goiter is never so great that we should operate upon those who are suffering with a lung complication, as pneumonia causes too high a percentage of deaths to take such chances. The state of the heart in patients with ordinary goiter is not so serious as in those with hyperthyroidism. Known heart disease, such as valvular disturbances, rarely cause the sudden deaths during operation that are ascribed to myocardial changes.

In exophthalmic goiter a rapid heart action of 120 to 150 does not constitute an extra-hazardous risk if the tension is even and the action steady. As a rule, a few days' observation should be given these cases before recommending operation. Patients who are not advised to have immediate operation are often kept under observation for weeks until we are satisfied of their ability to withstand surgical treatment. Aside from rest, internal treatment consists of extract of belladonna, 1/6 grain, with quinin in pill form, given three or four times a day. If no improvement is noticed, we use the *x*-ray exposure to the extent of skin irritation. Cases with diarrhea or gastric disturbance from the excessive nervous exhaustion and toxic influence give a higher mortality if operated upon at such times. Acute cases, in patients under twenty years of age, require great care and preparation to secure a successful result.

Anesthetic.—The choice of anesthetic in goiter operation is a most important question. Whether it be some kind of local or some special method of general anesthesia is frequently decided by the prevailing fad of the day. Kocher is often referred to as employing the local anesthesia. It could also be said that he used chloroform in hundreds of cases without a death from the anesthetic, and of his ether cases, there was possibly one death from bronchitis. Von Eiselsberg likes a general anesthetic, as does Shepherd, of Montreal. We much prefer it to the local, having found only 13 cases out of 300 in which we considered infiltration advisable. Operating upon other necessary and serious surgical conditions in those suffering with hyperthyroidism occasions about the same risk as operating upon the gland itself. The reason given by many for the choice of local anesthesia is that, by its use, the conscious patient may phonate upon request, and this lessens the danger of injury to the recurrent laryngeal nerve. A very forcible reason for its use is the lack of professional anesthetizers, which hampers many surgeons in their work, compelling them to divide their attention between what is, at best, a serious operation, and the anesthesia. We employ the open, drop method of anesthesia. Profound anesthesia is unnecessary and should be avoided.

Twenty to thirty minutes preceding the beginning of the anesthetic the patient receives a hypodermic of from $\frac{1}{6}$ to $\frac{1}{4}$ grain of morphin, and $\frac{1}{120}$ to $\frac{1}{100}$ grain of atropin. This allays much of the nervousness and prevents the disagreeable bronchial mucus which comes possibly from irritation of the ether, as well as from local traumatism of the trachea, which is so frequently bared a distance of 2 to 4 inches in the operation. Much of the respiratory embarrassment at this stage is from traction upon the tumor, which displaces or distorts the trachea.

As to the shock of the anesthesia, we have seen exactly the same type of shock follow the local as the general anesthesia in operating for exophthalmic goiter. In our experience, we can work more rapidly with the patient under general anesthesia, the operations being usually completed in from twenty to forty minutes.

Operation.—During the operation the table is maintained in a slanting posture (reverse Trendelenburg), and a roll of gauze is placed under the patient's neck, to facilitate dissection, unless the position embarrasses respiration.

Incision.—In our early work upon goiter we employed the angular or bayonet type of incision on the inner side of the sternomastoid muscle. This incision could be made sufficiently large to give a good exposure, but the resulting scar was anything but cosmetic, and the greater number were made through the ordinary collar incision, which closes perfectly, with an almost imperceptible scar on the front of the neck, parallel with or in one of the skin lines. The incision is made from one external jugular to the other, unless the tumor is a small one. The platysma myoides muscle is incised in the same manner, and lifted above and below with the skin-flaps. The dissection is sufficient to expose the fascia covering the lower portion of the sternomastoid and the sternohyoid muscles, from the thyroid cartilage to the sternum. The thyroid gland is brought into view by a vertical incision between the anterior jugular veins and the two sternohyoid muscles. These muscles, together at their upper portion, separate above the sternal notch, while the two sternothyroids reverse this form, separating at their upper portion.

Spreading these muscles in the midline brings the operator upon the fascial covering of the gland, and exposes many large veins. Small tumors and fairly large cysts can be removed through such an incision without muscle section. Operations upon large tumors and most cases of hyperthyroidism, where extirpation is desired, are made safer by having a muscle section of part of this group of muscles on at least one side. This is made by cutting the muscles between two forceps, which are placed upon them at their upper portion, close to the thyroid cartilage. Such a section does not injure the nerve-supply, which is derived from the communicans and descendens of the hypoglossi. Usually, the sternothyroid will not require section, as its upper portion is attached at a considerable distance from the midline. Turning the muscles held in a lower forceps outward, the region of the superior thyroid artery comes into view, and this important vessel, with its vein, is caught. The lateral vein of the capsule is exposed by muscle traction and cut between clamps; this is also done with the inferior of the same side.

The capsule is incised along the side of the gland, and as the tumor is lifted, the capsule is brushed back with gauze, the posterior capsule being left in place. As a number of deaths following thyroidectomy are from secondary hemorrhage, great care should be taken with the application of ligatures. The vessels in this region, including the inferior thyroid, are caught as seen in the dissection. The inferior thyroid is ligated at times before it reaches the capsule of the gland. The isthmus is crushed with large forceps and closed with locking suture. In many of the cases of hyperthyroidism it is deemed best to remove the lower half of the left gland as well, the dissection being slanted from the top of the isthmus to a point below the lateral vein.

In removing the thyroid from the posterior capsule which covers the recurrent laryngeal nerve and parathyroid great care is exercised not to remove any gland-like bodies for fear that they are parathyroids. While the loss of the thyroid in infancy prevents development and produces and induces the condition of cretinism, its loss later may cause degeneracy, and in the adult develop myxedema. The removal of one or two parathyroids in the extirpation of the gland in hyperthyroidism may cause sufficient nerve disturbance to add great danger to the operation. Injury of one laryngeal nerve by division is not so serious a matter as was supposed, the ordinary tone of voice being only slightly hoarse; the opposite vocal cord seems to compensate fairly well, except in the efforts to speak loud, when the sound may become a mere whisper. Small nodular tumors, separate follicles of encapsulated colloid, adenomata, and cysts in the gland are best treated by enucleation. Nature has outlined the useless and diseased tissue by encapsulating it. The same rule can be observed in their removal as in the treatment of cysts in other regions and organs. Penetration of the gland capsule or part of the gland tissue is made until the unmistakable luster of the encapsulation is seen. The space is closed with several lock sutures after enucleation. In such a method of operation there is no risk of injury to the parathyroids or nerves, and there is no increased danger from myxedema over their former condition, as the active gland is not removed.

Retrosternal growths, being usually encapsulated, can be safely elevated if the exposure is not ample; increased space can be obtained by splitting the lower skin-flap in the center to the sternum.

Tracheal traction, in elevating the tumor, often causes great temporary difficulty in breathing. As a rule, the softening of the tracheal rings is lateral, and from pressure.

Twice we found it necessary to suture the trachea to lateral tissues to prevent its collapse after removal of the gland. In carcinoma we have found the trachea to be softened by anterior pressure, and to be frequently invaded by the disease. Slight anomalies in development of the thyroid may cause unusual tumors. Accessory glands are found from the foramen cæcum in the tongue to the isthmus, also laterally beneath the gland. We have seen two thyroids of the tongue and two over the thyrohyoid space. Twice there was not a vestige of gland on one side of the trachea. In another case a cystic thyroid formed between the esophagus and the trachea, the latter lying just beneath the sternohyoid muscles.

After removal of the gland section in cases of hyperthyroidism the wound area is well washed with Harrington's No. 9 solution—alcohol, 640 parts; hydrochloric acid (chemically pure), 60 parts; water, 300 parts; and bichlorid, 0.8 part. This acts as a caustic irritant, causing the wound to be automatically washed with serum, which is not absorbed, but is drained through a separate stab wound just above the sternal notch. The majority of cases are drained for a day or two. It increases the comfort of these patients, although in a few instances small tumors are removed without drainage.

If the anterior group of hyoid and thyroid muscles has been severed, they are now united. The platysma myoides muscle is closed by a running suture of catgut from one angle of the incision to the other, the same suture being run back as a subcuticular suture and tied to the first end of the thread. If a subcuticular suture alone is employed, the platysma retracts and later pulls the scar, resulting in the formation of a false keloid.

In all cases a rectal enema of normal salt solution is given slowly without pressure after operation, and this is repeated at intervals the first day. Especially is this done after operation for hyperthyroidism, the quantity given being from two to three quarts in all. If they develop diarrhea, the saline is given at intervals subcutaneously in a somewhat less quantity.

We expect a quick pulse and some rise in temperature on the second day—from one to four degrees above normal. This is not looked upon as serious, and subsides before the third day in ordinary goiters, and by the fourth day in exophthalmic cases. No great effort is made to reduce either. We have secured no permanent benefit from adrenalin. Strychnin is dangerous in quantities sufficient to cause an effect. Should these patients have excessive sweating, they are given atropin. If very restless as well, morphin is also given as needed and the salines pushed. An almost uncountable pulse in those accustomed to such condition is not necessarily dangerous if their mental condition and expression remain good.

In cases of hyperthyroidism it may be that removal of one side is not sufficient to cause more than a partial recovery. A second operation to remove a portion of the remaining gland is then advised, and personal experience indicates that this is fraught with much less risk than the first operation.

There are no more wonderful results in surgery than the immediate effects of operations upon the thyroid. These patients are most grateful, whatever the size or character of the gland removed.

The operative recovery is rapid; rarely are patients confined to bed more than two or three days, and the hospital time does not average more than one week.

In this series all but one of the deaths following operations for hyperthyroidism occurred within twenty hours. In fact, we have but little to fear over the outcome of the operation unless valuable time has been wasted in experimental medication, until heart complications develop unavoidable risks.

GOITERS OF THE YOUNG*

CHARLES H. MAYO

One of the most interesting phases of the study of the function of the thyroid gland is its relation to the uterus and sexual pelvic organs in the female. The thyroid of the mother usually enlarges to some extent during the latter part of pregnancy, although excessive activity of the gland may occur with but little enlargement. It rarely occurs that women become pregnant during the period of an excess of secretion, hyperthyroidism, or during the opposite condition, myxedema or hypothyroidism.

Should the thyroid function be deficient in the infant at birth, the child fails to develop properly either mentally or physically, and it is in such cases that marvelous results are occasionally obtained by feeding thyroid.

In the human embryo the ductless glands of the neck show very early. The thyroid gland develops from three buds, the greater portion being formed from the median bud, which is situated between the lobes of the tongue, and from which the isthmus and greater portion of the lateral lobes are developed.

The lower poles are formed from buds originating in the fourth branchial groove. It is by anomalies of development that the median bud remains in the tongue as a lingual thyroid, or that accessory thyroids are formed in these areas of development, and occasionally one or possibly two portions fail to unite with the others, as they should at the seventh week of the embryo. Such a condition is common to the vertebrates, but unusual in the human.

The thyroid gland varies in size and weight in the healthy adult from 1 to 1½ ounces. It is inclosed in a capsule which divides behind into three layers, one of which passes behind the esophagus, one between the esophagus and trachea, and one incloses the posterior portion of the gland, fixing the structure to the trachea and to the thyroid and croicoid cartilages.

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* "Southern Medical Journal," July, 1908.

This capsule, inclosing so many important structures as well as the gland, is the cause of many of the symptoms of goiter other than those of oversecretion.

In the wonderful provision for a blood-supply the thyroid bears out our present knowledge of the importance of this organ. The loss of both common carotids would still leave the inferior thyroids, while in many cases a fifth artery exists in the center below, arising from the arch of the aorta or from one of the common carotids.

At present a great deal of attention is being paid to studying the function of the parathyroids. In operating upon the neck it is imperative to see that the parathyroids are not injured. From the irregularity of their location, their number, and their blood-supply, it would appear that nature had been extremely careless with these glands, or that we are mistaken in their importance.

The cretin may have no apparent thyroid, or may have a very large goiter. Operations on these tumors to remove a nuisance are indicated, and at times it becomes necessary to relieve dyspnea, but operation should not be expected otherwise to improve the condition of cretinism.

If the thyroid is enlarged in these cases, it is usually of the fetal type; no lumen in the cells, no secretion, and plenty of connective tissue, or, with more cells, less connective tissue, and cystic degeneration of the whole. In the normal thyroid the cells have matured and lined the vesicles, and opened a central space between them for secretion.

Simple or colloid goiter or diffuse adenoma is that condition in which the central space between the cells is greatly enlarged and retains a stainable colloid. If the colloid is granular, with recent degeneration of cells, we may have symptoms of hyperthyroidism, the type of exophthalmic goiter which develops in those with goiter of some years' duration. Should flattening of the cells occur in those of the colloid type, there is a tendency toward myxedema.

Encapsulated adenoma or rounded tumors occupying a part or the whole of the lobe may be seen. Often, by growth within the true capsule of the gland, these tumors develop to a great size and undergo partial or complete cystic degeneration. Such tumors are best treated by enucleation.

The usual exophthalmic goiter shows a wonderful hypertrophy of cells, with less colloid, at least in the active areas. Excluding infection and malignancy, all goiters come under one of these types.

The simple enlargement of the gland in girls at puberty is a fairly normal condition, and indicates that menstruation is becoming established.

In some cases there may be signs of hypersecretion at irregular intervals, occasionally amounting to mild exophthalmic goiter without proptosis. These cases seldom require any active medication or special treatment other than hygienic, as most of them recover within a period of months or a few years at most.

It very rarely occurs that colloid or diffuse adenomatous goiter in the young becomes so resistant to treatment or so annoying to pressure symptoms that extirpation or resection of a portion of the gland is necessary, although it at times may be advisable. Occasionally during this period, however, an encapsulated adenoma may develop into a rounded tumor occupying some part of the gland. It is best to remove such tumors.

Most physicians have a remedy for the cure of such goiters, and these remedies run from amber beads, etc., externally, and some form of iodin internally. Others lay great stress upon a special diet. Personally, we prefer some form of iodin internally, with intermittent external irritation over the gland.

Exophthalmic goiter in the young is a most serious condition. It may appear at a very early age; we have had a marked case beginning at the age of five years, which was operated upon at seven with great benefit.

The unusual age in which hyperthyroidism develops in the young is between sixteen and nineteen years. In such cases some form of medical treatment should be instituted to improve the condition, but should not be persisted in when ineffectual until surgical treatment must assume the burden of a mortality which, from the delay and consequent terminal degenerations, should be in part medical.

THORAX

PNEUMOTOMY *

CHARLES H. MAYO

Reports of cases of removal of foreign bodies and drainage of abscess and gangrene of the lung by pneumotomy have grown in frequency since the operation has become more generally used for the relief of these otherwise almost hopeless conditions.

There are a few points of interest which must of necessity be considered in making a diagnosis or operation on these cases.

The two pleural cavities do not communicate, and are in contact only at one point, behind the upper border of the second bone of the sternum.

The lungs rise in the neck, 1½ inches above the first rib; each lung is divided into two lobes by a deep fissure, which begins about 3 inches from the upper posterior border, and extends down and forward nearly to the bottom of the lung in front. The right upper lobe is divided into two parts by a short, deep fissure, the lower half forming the middle lobe of the right lung. The root of the lung is a little above its middle on its inner side, at which point it is connected with the heart and trachea. The root is formed by the bronchial tube, pulmonary artery and veins, bronchial arteries and veins, pulmonary plexus of nerves, lymph and bronchial glands, and areolar tissue, all inclosed by a reflection of the pleura.

The bronchial arteries supplied from the aorta are the nutrient vessels of the lung; they follow the posterior wall of all the bronchi, and are entirely separate from the pulmonary aërating system. The lung does not fill the pleural space, which explains the absence of dyspnea in some cases of large abscess or effusion, and permits compensatory use of other portions of the lung.

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* Reprinted from the "Minn. State Med. Soc. Trans.," 1898, p. 106.

Abscesses of the lung are diffuse or circumscribed, and occur as acute or secondary, following directly upon pneumonia, foreign body, aspiration of vomit, empyema, and gunshot wound or injury to the chest.

Secondary abscesses of the lung are more often diffuse, and due to pyemic conditions causing septic emboli and infarctions, as in sinus phlebitis, otitis media, uterine sepsis, tuberculosis, etc.

The signs and symptoms of abscess consist of a localized and unnatural area of dulness, changes in the respiratory murmur, increased fremitus and bronchial whisper, with increased vocal resonance, proved to exist by exploration with a large aspirating needle. If rupture into a bronchus occurs, there is expectoration of offensive, greenish or dark-colored sputum, with a changing area of dulness and signs of a cavity.

The microscope discloses septic microörganisms or tubercle bacilli in the sputum, the constitutional symptoms of which are similar to abscess in general, chills, fever, sweating, loss of appetite, with emaciation.

Gangrene occurs in two forms,—diffuse and circumscribed,—and is usually located in the lower lobe, with septic microbes always present. The history, the presence of cough, pain, rapid respiration, expectoration of pus with necrotic tissue, foul odor of the breath, with chills, fever, and rapid pulse, all aid in making a differential diagnosis.

Hydatid cysts of the lung, while rare in this country, form 10 per cent. of all hydatid cases. They are of slow formation, having the general effect of a solid growth, but lacking in the septic properties of abscess or gangrene. The aspirating needle and microscopic examination of withdrawn fluid for echinococcus hooklets confirm a probable diagnosis.

At the present time pneumotomy for foreign body is seldom applied, except when abscess has formed.

The operation of pneumotomy is made in two steps—first, opening the chest-wall; and, second, incision of the lung. It is performed in two periods, depending upon the judgment of the operator as to the ability of the patient to bear the pulmonary part of the operation, or the lack of adhesions of the pleura at the point selected for the incision may necessitate delay.

Fenger's method of proving the presence of adhesions is to insert an aspirating needle deeply into the chest at the point selected for incision. If the needle movement is slight and with that of the chest, adhesions are probably present; if the needle moves freely with respiration, the lung is probably free from the chest-wall.

The thoracic operation requires the resection of portions of from one to five ribs, which may be rapidly removed by rib-cutters or rongeur forceps.

When the pleural adhesions are firm, the incision may be continued into lung tissue. If the abscess is deeply situated, the aspirating needle, grooved director, small blunt forceps, or Paquelin cautery may be used in effecting drainage. The abscess, once opened, can be drained by gauze with rubber drainage-tube.

In cases where the pleura is not adherent and the thoracic opening permits the surgeon to work in the general pleural cavity, the costal pleura may be stitched to the pleura of the lung at the margin of the wound, as suggested by Godlee, opening the lung at once, if necessary, or if delay is possible, to pack the wound a few days for firm adhesions to form and make the lung incision a secondary operation. This may avoid complicating the condition with an empyema. Should infection of the general pleura occur, immediate drainage is indicated. Many elaborate trap-door incisions of the thorax are described for exploring lung tissue, one of the best is a trap-door incision the depth of the entire chest-wall and three to five ribs in width, turning the flap forward, the costal cartilages acting as a hinge.

The cases under consideration are more or less acute, as a rule, secondary to other prostrating diseases, and these patients will not stand the prolonged operations made for the radical cure of chronic empyema.

The operation of necessity must be that method which, after careful localization, can be made quickly and safely, and the sacrifice of a portion of the ribs is of no consequence as compared with the loss of time. Should free hemorrhage occur, the lung wound must be deeply tamponed by gauze, and a drainage-tube used a few days later upon the removal of the gauze.

If drainage is efficient, irrigation is unnecessary, and in case of ruptured abscess is dangerous from fluids flowing into the bronchi. Three illustrative cases are reported herewith:

Case I.—Mrs. D., aged thirty-nine years, a very fleshy woman, with whom pneumonia of the left lung terminated in gangrene.

Operation.—Resection of a portion of two ribs in the axillary line. No adhesions. Drainage of a large abscess of gangrenous lung tissue. Death from exhaustion on the third day.

Case II.—C. N., male, aged twenty-five years. Abscess of left lung, lower lobe, following a tuberculous pleurisy; cavity communicated with bronchus.

Operation in posterior axillary line. Adhesions present. Drainage for three weeks. Great improvement primarily, followed by death from general tuberculosis in five months.

Case III.—Mrs. E., aged thirty-eight years. Tubercle bacilli were found in the sputum. Abscess of left lung, which had ruptured into bronchus; abscess had followed prolonged drainage for empyema.

Operation.—Drainage in anterior axillary line after resection of the portions of three ribs. Firm adhesions of pleural surfaces present. The lung was incised, and drainage maintained for three weeks. Recovery, with great and continued gain in general health.

BONES AND JOINTS

A REPORT OF A YEAR'S WORK IN FRACTURES *

W. W. AND W. J. MAYO

In the treatment of fractures we have no splint which possesses the occult power of iodoform in wound surgery to convert bad work into good; nor can we often claim that "the germs have raised the deuce with our result in spite of rigid antisepsis." In general, we use molded splints in the treatment of these cases, and, where practicable, apply a plaster dressing after the swelling abates. In fracture of the clavicle we find a compress of adhesive plaster at the seat of injury, held firmly by long straps of the same, to be a valuable adjunct to the methods of retention in ordinary use. In fracture of the tibia an efficient, comfortable splint can be readily improvised by placing the leg upon a feather pillow laid lengthwise; pull the sides of the pillow upon the leg, and place light board splints outside, retaining the whole by six or eight bands tied in front. In Colles' fracture of the radius we believe deformity is more frequently due to incomplete reduction than to any displacement of the fragments after complete reduction.

Fractures of the Head

Case I.—A. P., male, aged eight years. April 13, 1885, sustained a compound fracture of right parietal bone, 1½ inches in diameter, and just above the ear, caused by a sweeping blow with a bolt. About a tablespoon full of brain substance escaped. The splinters were removed; a compress and bandage applied; recovery.

Case II.—E. P., male, aged twenty-four years. October 30, 1885, sustained fracture of the left inferior maxillary bone between

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*Reprinted from the "Trans. Minnesota State Medical Society," 1886, pp. 76-81.

the bicuspids, by indirect force. The fracture was easily reduced and retained by a four-tailed chin bandage.

Case III.—C. D., male, aged thirty-one years. December 21, 1885, received a compound fracture of the right inferior maxilla, between the second and third molars, by direct force. Great difficulty was experienced in overcoming the action of the masseter muscle upon the posterior fragment; it was finally adjusted, and retained by an interdental wedge of cork. This man was seen in consultation. He died on the tenth day of meningitis, probably due to basal fracture of the skull.

Case IV.—C. C., female, aged twenty-two years. December 27, 1885, received a fracture of each inferior maxilla by a fall upon the point of her chin. The left, fractured at the center of the body, was not displaced. The right, fractured between the last bicuspid and first molar, was compounded into the mouth, the posterior fragment being drawn in by the pterygoids. It was replaced and retained by wiring the teeth.

Case V.—F. S., male, aged thirty years. January 7, 1886, received a compound fracture of the right inferior maxillary bone by a mule kick. A canine and incisor, with a portion of the alveolar process, was removed, and the fracture retained by a molded pasteboard splint.

Fractures of the Trunk

Case VI.—J. W., male, aged sixty years. August 23, 1885, by a fall from a stack upon the back of head and neck, fractured the spines of the fourth and fifth cervical vertebræ. His head was carefully supported in a slightly flexed position by a large pad extending from the shoulders to the occiput. He had a convulsion on the sixth day, caused by a slipping of the compress and sudden extension of the head, producing pressure on the spinal cord, which was at once checked by flexing the head. Recovery with immobility at the seat of fracture.

Case VII.—J. K., male, aged fifty-nine years. November 20, 1885, fracture of the ninth and tenth ribs at the angle upon the left side, caused by a fall. A wide flannel bandage around the thorax and pinned firmly gave relief until union had taken place.

Fractures of the Upper Extremity

Case VIII.—J. C., male, aged forty-one years. August 28, 1885, fracture of the surgical neck of the humerus by indirect force, easily reduced, and retained with a long, right-angled splint of molded pasteboard externally and a short inside splint. Recovery good.

Case IX.—A. H., male, aged twelve years. August 3, 1885, fracture of the internal condyle of the humerus, with dislocation of the forearm backward, caused by direct force. Under anesthesia the dislocation was reduced. The arm was put up in a molded pasteboard splint at less than a right angle, the fracture being supported by compresses. Passive motion was commenced after the third week. Recovery with almost complete motion at the elbow-joint.

Case X.—K. H., female, aged nineteen years. August 26, 1885, received a "T" fracture of the humerus by great force, causing extensive injury to the elbow-joint. The swelling of the joint was most intense and persistent. The arm was put upon an angular molded splint, and passive motion begun during the fourth week, though the swelling was yet marked. As this diminished, use of the arm was encouraged. Recovery with two-thirds normal range of motion of the joint and some deformity.

Case XI.—A. H., female, aged eight years. August 5, 1885, green-stick fracture of left ulna and radius at the middle third. The bones were bent back and shingle splints applied. Recovery speedy and complete.

Case XII.—E. P., male, aged twenty-four years. October 31, 1885, fracture of the right radius in the lower third by direct force. Fracture easily reduced and retained by pasteboard splints, with good result.

Case XIII.—C. S., female, aged forty years. December 17, 1885, Colles' fracture of left radius, giving the characteristic appearance of increased length of ulna with prominence of the external styloid process and shortening and incurvation of the radius. The fracture was reduced with some difficulty, and retained upon a molded copper splint of the Levis pattern. Result, slight deformity; otherwise good.

Case XIV.—C. J., male, aged forty-seven years. August 8, 1885, compound fracture of fourth metacarpal bone by the needle of self-binder. A palmar splint with compresses were applied at seat of fracture, and the hand bandaged over a roller bandage clutched in the palm. Result, fourth distal extremity lower than the other knuckles; fifth in good position.

In our experience the so-called "knocking down" of the knuckle is frequent after this fracture. In compound fractures of the digits we have had most excellent success by the use of splints and sutures, with a little tension where necessary, and keeping the bandages and dressing constantly soaked in a 1 per cent. solution of carbolic acid until granulation is active. The relief to pain is immediate, and the recovery prompt, in cases where amputation of some portion seems almost beyond question. We heartily recommend this plan in the frequent cases of smashed fingers.

Fractures of the Lower Extremity

Case XV.—W. W., male, aged three years. July 10, 1885, transverse fracture of the middle of right femur by a fall. Fracture easily reduced, and retained by a long splint. A plaster cast was applied in the third week. Result, union without shortening.

Case XVI.—E. P., male, aged twenty-four years. October 30, 1885, compound angular fracture of the middle third of left femur by indirect force. Fracture reduced by extension, which was continued for four weeks in the usual manner by a weight and pulley. This was followed by a plaster cast. Recovery, with ¾ inch shortening.

Case XVII.—F. McC., male, aged seventeen years. December 23, 1885, gunshot wound of left thigh at the juncture of the upper and middle thirds, chiseling a rough notch in the inner side of the femur. The fracture was incomplete, requiring no splints. Free drainage with tubes was established. Recovery.

Case XVIII.—April 12, 1886. A small pet deer fractured the thigh bone of its hind leg close to the body and within an inch of the joint. The fracture was angular, and the ends of the bone drawn completely by through muscular action. The seat of fracture was laid open freely, the fragments drilled with a shoemaker's brad, and united with three stout silver-wire sutures. The wound was drained and dressed, and the animal swung up in a coffee-sack swing, allowing the legs to project through holes in the sack. At this writing ten days have elapsed, and the animal appears to be doing well.

Case XIX.—H. M., male, aged fifty-nine years. June 14, 1885, fracture of the tibia just beneath the tuberosity, with dislocation of the superior fragment outward from the joint. The fracture was reduced with great difficulty. The leg was placed upon a feather pillow, the edges of which were drawn well up and retained by light internal and external splints, with eight bands tied in front. A plaster cast was applied in two weeks, with good result.

Case XX.—H. S., male, aged twenty-seven years. November 12, 1885, compound fracture of right tibia, lower third, by being thrown from a horse. Fracture was reduced by extension, and retained in a fracture-box. Good recovery.

Case XXI.—A. P., male, aged ten years. March 1, 1886, fractured the lower third of left tibia by a fall. Reduced by extension and retained upon a posterior molded copper splint. Good result.

COMPOUND FRACTURE OF THE LOWER END OF THE HUMERUS, WITH SIMPLE FRACTURE OF THE CONDYLES AND HEAD OF RADIUS: EXCISION RESULTING IN GOOD MOTION*

WILLIAM J. MAYO

W. H., male, aged ten years. September 10, 1886, was thrown from a horse, striking upon his left elbow, producing a simple comminuted fracture of the condyles and head of the radius, with a compound fracture of the shaft of the humerus 2 inches above the articulating surface, the upper fragment of the shaft projecting through the skin, his shirt, coat-sleeves, and 2 inches beyond. Under chloroform I enlarged the external wound, which was on the outer side of the arm, and after a thorough cleansing reduced the fracture, made a counteropening in the under side, and introduced a large drainage-tube. The arm was laid upon an angular copper splint with an absorbent cotton dressing. This dressing was not removed for ten days. At that time the arm and hand were found badly swollen, the upper fragment of the shaft of humerus engaged in the wound, and a small amount of suppuration. General condition excellent. Various methods of retention were tried, but with the exception of the straight posture, all failed on account of the position of the external wound. Any degree of an angle caused the bone to protrude, because of the fracture in the joint. This position was impracticable because of the probability of ankylosis in an unfortunate situation.

Excision of the lower end of the humerus and head of the radius was decided upon. This was accomplished on September 24th by enlarging the external opening downward, opening the joint, and carefully dissecting out the fractured bone-ends. The upper fragment of the humerus was also shortened, leaving the ulna intact and the radial attachment of the biceps uninjured. The wound was thoroughly drained, and the arm placed upon a straight splint with an absorbent cotton dressing; the healing was rapid.

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*Reprinted from "Northwestern Lancet," November 15, 1886.

Result: The arm is two inches short, pronation and supination imperfect, but improving. Extension and flexion two-thirds of the normal range.

Might it not produce better results in many of the T-fractures of the humerus, when fixation of the joint is probable, to excise the fractured ends, being careful to remove sufficient from the humerus to prevent ankylosis and give motion to the arm?

SEPTIC DISEASES OF THE KNEE-JOINT *

CHARLES H. MAYO

The great size and peculiar formation of the knee-joint, with its many communicating bursæ, render its destruction probable by infection, and the loss of the limb, or life itself, is of comparative frequency.

A brief review of the more important of its anatomic features will explain why sepsis is so destructive.

The strength of this largest articulation of the body is in its powerful ligaments, which unite the opposing surfaces, articulating only by contact. The bony axis of the limb changes at the knee, the femur slanting inward from above and the tibia being vertical. The lateral ligaments of the joint have the least strength. The posterior are strong, and the capsule becomes ligamentous anteriorly. The most powerful and important ligaments of the joint are the crucial. The synovial membrane extends above the patella and beneath the extensor tendon, the culdesac reaching a point one inch or more above the trochlear surface of the femur. Above the synovial sac is a bursa about one inch long, separating the quadriceps tendon from the femur, and communicating with the joint in four out of five cases. The upper third of the ligamentum patellæ is separated from the synovial sac by a pad of fat; the lower two-thirds are in relation to the bursa, interposed between it and the tubercle of the tibia. In the popliteal space, interposed between the internal condyle of the femur, the inner head of the gastrocnemius, and the semimembranosus, is another bursa, usually communicating with the knee-joint. The bursa beneath the popliteus tendon always connects with the joint, and usually

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*Read before the Wabasha County (Minnesota) Medical Society. Reprinted from the "Jour. Amer. Med. Assoc.," March 20, 1897.

with the tibiofibular articulation. The posterior part of the synovial sac has other bursal pouches in the adult. The epiphyseal line of the femur is intracapsular, showing the route of infection in the complicating joint abscess, occurring in some cases of periosteal and osteomyelitic diseases, and the source of effusion in fractures involving this region.

In a consideration of septic diseases of the knee-joint we are concerned only in the more simple injuries causing synovitis, when autoinfection renders them septic. The entrance of blood into the joint is of the same significance, as a slight injury may occasion a hemorrhage, which never entirely coagulates, regardless of the quantity effused, but mixes with the synovia, and its absorption is extremely slow. These cases, through delay in absorption or improper management, may develop the simple purulent synovitis.

Acute purulent synovitis occurs in young children, as a rule, in the first few weeks of life, and has been considered a probable umbilical infection. These cases discharge early, and in most cases the joint function is not permanently impaired, as shown by Krause and Volkmann. In case of doubt concerning the character of a joint effusion the hypodermic can be used for aspiration with the same freedom as it is now used on the chest to demonstrate fluids in the pleura. The withdrawal of a small quantity of serous effusion has the same effect as is so frequently noticed in the pleura—the stimulation of absorption. In the more simple purulent collections, a large-caliber hypodermic needle can be used to withdraw the contents of the joint, and then distend it with a 1:1000 bichlorid solution. After a massage of the joint withdraw the bichlorid solution, repeating the process with normal salt solution.

Gonorrheal synovitis, which has been shown by Councilman and Ott to be due to autoinfection by the gonococcus, may be treated in the same manner, after a thorough trial of large doses of potassium iodid has been made without relief.

Penetrating wounds of the knee-joint, including incised, punctured, lacerated, and gunshot injuries, are well classed among the most dangerous of bodily injuries not proving immediately fatal. Their gravity depends solely upon the introduction of septic matter into a serous cavity at the time of injury or during its subsequent care.

The simpler forms of lacerated and punctured wounds are the most frequent, as distinguished from the complicated cases in which the injuries to adjacent structures may be of more serious consequence than the opening of the joint. Where the wound is small and the synovial sac not visible, great care must be exercised in judging of joint penetration. The free flow of synovial fluid may only indicate the opening of a bursa or large tendon-sheath; the rapid distention of the joint with blood may also come from a contusion, without joint penetration.

In cases in which the nature of the injury would indicate a possible foreign body, septic origin, or contamination, the probable diagnosis must be confirmed by exploration of the wound, under strict antiseptic precautions, when, should the synovial sac be found opened, the interior of the joint should be thoroughly flushed with a 1:1000 bichlorid solution and drainage established, preferably by means of folded rubber tissue, and a copious dressing applied. In cases of joint injury, where we can be reasonably certain of an aseptic wound, an antiseptic dressing may be applied, with rest of joint, awaiting the development of symptoms before further interference.

Should infection occur during treatment, the incision should be enlarged, antiseptic irrigation applied, and freer drainage established. Synovia may flow for several days, and unless infection supervene, a perfect recovery results. In those cases in which infection occurs the result obtained will depend upon several factors, viz.: The nature and degree of infection, the freedom of drainage, and the treatment applied. Infection produced by the less virulent pus-producing germs may not be clinically demonstrable for from two to seven days. The turbid effusion, filled with flakes of lymph, will then indicate vascularization of the synovial sac. The joint becomes red, swollen, painful, and tender; a chill, more or less severe, indicates the commencement of infection.

Systemic toxemia is evidenced by a fever, which continues as long as the joint is distended with pus. In the less virulent infection, if a free drainage is secured, the joint structures may be maintained and a fair degree of joint function preserved, even after several weeks of discharge. Insufficient drainage, or a more virulent form of infection, may so rapidly disintegrate the joint structures that a functional result is impossible. The ligaments become softened, the cartilages necrosed and separated, the synovial membrane thickened, and the extension of the purulent process into adjacent bursæ and tendon-sheaths develops abscesses in the thigh and posterior tibial regions. The limb is enormously swollen, and the general septic condition is very marked. Life may be saved and recovery hastened by an early amputation, otherwise death may ensue from toxemia, or after months of discharge life and limb may be saved, with a functionless joint.

In the case of streptococcus infection the course is more rapid and death frequently occurs early, from phlebitis, gangrene, or septicemia. In mild or mixed infections secondary to chronic joint disease it is possible to have a walling off of the abscess in a portion of the synovial pouch, as mentioned by Andrews, similar to like conditions in the peritoneum or pleura. Gunshot wounds of this joint require the same care as the lacerated and punctured wounds. Injuries by large missiles require exploration, and in case of serious bone injury a partial arthrectomy may be necessary, while those made by small-caliber bullets may be treated as doubtful cases until interference is demanded by the symptoms developed.

Bullets are usually sterile, but there is always danger from the particles of clothing carried in by them. In gunshot wounds of this joint, unless serious hemorrhage occurs requiring control, the first consideration is the application of an antiseptic dressing. Dividing the knee-joint cavity into spaces and treating suppuration by drainage with four to six drainage-tubes, as recommended by Andrews and Gerster, suffice for some cases, and may be supplemented by a tube drain through the popliteal space, as practised by Hartley. Edmund Owen recommends the vertical incision on either side of the patella, and in some cases connects the two incisions by cutting the patellar ligament.

Frederic S. Dennis and Roswell Park report cases successfully treated by continuous irrigation or immersions in weak antiseptic fluids. The one essential feature in the treatment of the more serious forms of phlegmonous inflammation of the joint is free drainage. The transverse incision, from prominence to prominence of the condyles across the front of the joint, as made for resection, presents the freer exposure for dry gauze pack of all parts of the joint, or the use of the gauze pack saturated with a solution of 5 per cent. balsam of Peru in castor oil, so successfully employed by W. W. Van Arsdale in the treatment of suppurating wounds. This incision will accomplish all that an amputation can promise, with less shock and with the saving of a useful limb, and in many cases a limited degree of motion.

In three cases in which the patella was severed through its center the two halves afforded a firm hold for passing sutures behind and closing the joint at a later period.

In the January, 1895, issue of the "Annals of Surgery" I reported my first case treated in this manner, and the successful treatment of 4 similar cases in the past two years leads me to emphasize my former statements. Two of these cases have one-fourth motion.

In the "Annals of Surgery," vol. xxii, p. 503, in report of transactions of the New York Surgical Section, Arpad Gerster so perfectly describes the treatment I have used in these cases that I will quote in part from him: "Dr. Mayo's suggestion struck me as being very plausible, and he has applied it in two cases. The result had been excellent. As all know, these acute forms of joint phlegmon necessarily end in ankylosis, if, indeed, they do not cause loss of limb or life. The cartilaginous covering of the bones forming the joint is destroyed, and therefore ankylosis is inevitable. Knowing this fact, the surgeon, in adopting this method of treatment, frankly accepts the necessity for ankylosis. The road then becomes very clear. The treatment consists in laying the joint open by a transverse incision, extending from one condyle to the other, just as a joint is laid open for resection. Then as many more incisions are made as may be necessary, in order to open up every collection of pus or fluid in or about the joint. The capsule in all these cases is very intumescent and swollen, and for this reason occludes all drainage-tubes in a way to make retention inevitable. Then lay the joint freely open, removing or not removing tissues, as the case may be, pack and drain every recess, and treat it as an open wound. It is astonishing how rapidly the phlegmonous process ceases when compared with other methods of treatment. After the symptoms of active inflammation have subsided, the joint is put in proper position and ankylosis is allowed to take place."

THE PATHOLOGY AND DIAGNOSIS OF OBLIQUE FRACTURES *

WILLIAM J. MAYO

Aseptic and antiseptic methods have done much for compound, but very little for closed, fractures until recently. At this time we are in the midst of a most splendid advance in the diagnosis of fractures, due to the impetus given by the *x*-ray, and to the wider scope of the diagnostic incision which modern wound treatment has made possible.

The obliquity of a fracture is often the most important feature, and its diagnosis and management may prove to be the turning-point to the ultimate usefulness of the limb. As railway surgeons, we are vitally interested in this aspect of fractures, as the oblique fracture is characteristic of adult middle life and, for obvious reasons, constitutes the bulk of such injuries, both to the traveling public and to employes. The frequency of deformity after this variety of fracture, interfering with the utility of the member at a time of greatest usefulness, is a source of great pecuniary loss to the company, and in private practice, too frequently, of a malpractice suit against the surgeon. The green-stick and transverse fracture of childhood, and the senile or pipe-stem fracture of age, are far easier of adjustment.

Mudd concisely says that "an oblique fracture is one in which the line of fracture is at an angle of not less than 10 nor more than 70 degrees to the axile of the bone; it is an intermediate between a transverse and a longitudinal fracture. The surfaces are at such an angle that even if well adjusted, there is a disposition to overlapping, and any force tending to shorten the bone, whether it be pressure or muscular contraction, produces displacement, with consequent shortening. The fractured surfaces are disposed to slip, one upon the other, until there is overlapping." This form of injury is most often due to indirect force, and the resulting shortening depends upon obliquity and displacement. Such shortening constitutes the greatest disaster in the femur; ¾ inch or more causes a limp, pelvic droop, and compensatory spinal curves. In the upper extremity there is less liability of functional or cosmetic after-results, provided a joint be not involved.

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*Reprinted from "Jour. Amer. Med. Assoc.," 1898, vol. xxx.

There are some points in the pathology which are of the greatest importance. The formation of callus is not only from the bone and periosteum, but also from the soft parts; the lower maxilla, clavicle, and ribs, having but a small amount of tissue in close proximity, have less callus, and the callus formed is most abundant upon the side of the bone, where the soft coverings are most plentiful. Macewen, in his work upon bone growths, shows that true bone originates from any or all parts of the bone, medullary canal, and periosteum. Defective or too abundant callus may, of itself, cause displacement and consequent union with deformity, or, from excessive damage to any one element of bone formation, the same conditions may exist.

In paralytics and those suffering from certain constitutional maladies such errors in repair are most apt to appear. In rheumatic individuals the disturbances in the soft parts and neighboring joints may be the starting-point of a chronic rheumatoid arthritis, especially at the hip. Tillmanns calls attention to the peculiarities of the resulting deformity, for which the surgeon is wholly blameless. The influence of chronic inflammation of the bone, especially near the epiphyseal line, upon bone growths is noted by Senn. I have seen the tibia elongated an inch by a central abscess in the growing bone. Humphries and Corydon L. Ford have made extensive investigations as to asymmetry of bone length in otherwise normal individuals, and the frequency of such abnormalities should put us upon our guard in the measurement of broken limbs, while the possibility of error due to former injuries should be constantly in mind.

Oblique fractures not infrequently become entangled with the soft parts, and union is prevented by the interposition between the fragments of such material. Muscular action constantly tends to displacement of the fractured ends, and causes shortening, and this is especially marked in the femur. This bone also requires much time for solid union. Cheever says that he has known a fractured shaft of the femur at six or eight weeks, with ½ inch shortening, by injudicious use gradually to slip by, from pressure upon the callus, and give an ultimate shortening of two inches or more. I have seen a similar instance. In children union is more rapid than in adults, but caution should be used after fracture of this bone in allowing its use.

Dawbarn, in discussing the care of fractures, says that until the eighth or tenth day union is so incomplete as to render it possible to change the position of the bone-ends readily, and that until this time efforts should constantly be made, if necessary, to complete the diagnosis or to overcome the deformity. Rebreaking of a fractured bone which has united with deformity is followed by slow repair, and sufficient time should elapse before putting weight upon the limb to allow strong union and prevent recurrence of the malposition.

Time forbids the discussion of the pathology of fractures, or reference to such complications as fat-embolism, non-union, ankylosis, etc.

The classic signs of fracture are too well known to require discussion, and less difficulty would be experienced if we saw the injury at once, but usually several hours or even days have elapsed before the examination is made, and an exact diagnosis may be impossible on account of swelling. As a rule, an anesthetic should be administered. Crepitus is usually present, but may be absent on account of either impaction or the interposition of soft parts.

Preternatural mobility and loss of function may not be prominent features if only one bone be broken, either in the forearm or the leg. Shortening requires careful measurements, and, as suggested by Ashhurst, we should use several points of measurement for comparison. A possible asymmetry of the limb should be eliminated. Pain and swelling are not peculiar to fractures more than to other injuries, and do more to confuse than to help in the diagnosis. Bipolar pressure would cause more pain in a fracture than a contusion.

Before taking up the new methods of diagnosis by incision and the *x*-ray I wish to call attention to the great value of a procedure (credited to Gerster by Dawbarn, in the "New York Polyclinic," July, 1897) as an aid to the diagnosis of fractures about the elbow-joint after swelling has taken place. An anesthetic is administered, and a Martin rubber bandage is slowly applied from the fingers to the shoulder; at the expiration of fifteen minutes, during which time swelling is pressed out, the upper turns are tightened, to prevent blood from entering the arm, while the lower turns are completely removed to a point above the joint. By manipulation of the now greatly reduced elbow an exact diagnosis is arrived at and treatment instituted. The swelling soon returns upon the removal of the bandage, but the purpose has been accomplished. I have had occasion to try this method within a short time, and it proved useful.

The so-called "gunstock deformity," or loss of carrying power, so often seen after the common oblique fracture of the lower end of the humerus complicating the elbow-joint, has received attention from Allis, of Philadelphia, and Powers, of Denver, and, as a result of their observations the diagnosis and treatment of this class of injuries have been greatly improved. Credit should also be given to Roberts for his effort in behalf of fractures of the lower end of the radius, and to Royal Whitman for his practical observations upon the diagnosis of fractures of the neck of the femur in children ("Annals of Surgery," June, 1897).

Exploratory incision for the purpose of exact diagnosis and as an aid in treatment has been practised occasionally for some years. There is now a marked tendency to resort to this method in many cases of obscure bone traumatism at an early date. In an able article on fractures of the humerus complicated with dislocations at the shoulder-joint McBurney advocates incision, and has invented a traction hook to aid replacement. In the "American Journal of the Medical Sciences," April, 1897, G. W. Spencer gives a résumé of cases of fracture of the clavicle, exactly diagnosed and treated by incision, and Allis speaks for the open management of certain fractures ("Annals of Surgery," June, 1897). At the meeting of the Philadelphia Academy of Surgery, October, 1896, in a discussion of this subject, participated in by Deaver, Roberts, Hearn, and others, the consensus of opinion was in favor of incision in the diagnosis and treatment of obscure fractures.

Just when should incision be performed? There is no doubt that an immediate incision, before swelling has taken place, renders the aseptic after-management easier to secure. If there is much skin injury, with tendency to the formation of blebs and great swelling of the soft parts, incision is fraught with danger of sepsis, and a delay of a few days to obtain a sound skin site for incision is a safe plan, particularly as union of bone does not take place before eight or ten days. In a considerable personal experience I have found the intermediate period a bad time for incision.

The Röntgen ray as an aid to the diagnosis of fractures is one of the marvels of the day, and by this means the ability accurately to map out the fracture without removal of the dressings has revolutionized the diagnosis. So common is its use that almost every issue of our medical periodicals contains skiagraphs of bone traumatisms. It is a matter of regret that it can be utilized only in the larger hospitals or cities, and, unfortunately, its revelations at a late date are apt to prejudice a jury in the possible malpractice suit. In the very excellent skiagraph work by J. G. Cross I have noticed that ultimate result is often good, even when the bones are not accurately in place.

Leonard Freeman says, in this connection ("Annals of Surgery," April, 1897), "It must often be true that when we imagine we have placed fragments of broken bone in perfect apposition, they may not be so after all, and yet the result be good, nature being capable of smoothing off many inequalities."

Until we can better estimate nature's capacity for repair, the skiagraph may cause much needless anxiety, and, still more unfortunately for our piece of mind, show us errors in position which the condition of the soft parts will now allow us safely to correct, or the process of repair may, in the occasional case, develop rather than prevent deformity. The *x*-ray may be made to exaggerate the existing deformity or displacement. In an editorial in the issue for September 4, 1897, of the "Journal of the American Medical Association," *x*-ray injuries are thoroughly discussed, and the conclusion drawn that it is rare for serious skin lesions or other ill effects to happen in the hands of careful men. The rapid improvement of apparatus and technic will soon reduce such misfortune to a minimum.

OBSERVATIONS ON THE TREATMENT OF TUBERCULOSIS OF BONES AND JOINTS*

CHARLES H. MAYO

Because the disease is confined in an unyielding space compressing vital structures, tuberculous meningitis causes almost the only death due to tuberculosis alone. Deaths commonly attributed to the germs are probably the results of mixed infection.

Granulation tissue is the characteristic primary effect of the tubercle bacilli; other changes are secondary from various stages of retrograde metamorphosis or from mixed infection. The first product is the gray granulation or tubercle, which becomes later the yellow nodule, and, following this, coagulation necrosis, caseation, and finally liquefaction.

The growth or progress of the disease is favored by inherited or acquired diminished tissue resistance. Pus is not ordinarily produced by tubercle bacilli, but the fluid which so much resembles pus is the result of coagulation necrosis suspended in the product of liquefaction, and known as cold abscess.

Tuberculosis of bones and joints must be considered as a secondary lesion, that is, the bacilli must be carried in the circulation and deposited at its point of attack, the ends of the long bones, from their peculiar structure, favoring its deposit and growth. Acute osteomyelitis, as a rule, affects the shafts of the long bones, while this is a rare location for tuberculosis, except in the phalanges, when it is known as a spina ventosa. The periosteum is also rarely affected by tuberculosis, but frequently by syphilis.

In the light of pathologic disclosures during the past few years it has been shown that primary tuberculosis of synovial surfaces is rare, especially of the knee. Modern authors state that it does

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* Reprinted from "Trans. Minn. State Med. Society," 1899, pp. 90, 91.

not occur before puberty. Tuberculous synovitis is then a secondary invasion from the focus in the bone, and early relief by surgical intervention, before the joint is invaded, will mark the progressive surgeon and save many joints.

The deposit of tubercle in the epiphyseal end of bone produces an infarct or wedge of necrosis, corresponding to the region supplied by the artery involved. This region of lowered resistance is invaded by gray granulation, which passes through its varied stages of retrograde change, finally opening into the joint, or possibly into the shaft; rarely it works its way to the surface of the bone by way of the epiphyseal cartilage.

Tuberculous hydrops in the early stage is the simple increase of synovial fluid, the result of irritation; later, by direct infection of the synovial surface with destruction of cartilage and periarticular thickening, we have the various stages of tuberculous joint.

The advanced cases are those in which the products of degenerative change from the bone and of the synovial surface become suspended in the joint fluid.

The characteristic of repair is the change of the spongy granulation tissue into permanent tissue, and, according to its extent, we have the production of adhesions and deformity, with consequent impairment of motion and use. It is such results of disease which we endeavor to modify by treatment in cases too far advanced for cure. Tuberculosis sicca, a dry form, in which earlier or more common changes are absent, and yet the destruction of bones and synovia is marked, occurs frequently in the shoulder-joint, but rarely in patients under forty-five years old.

Young people complaining of some lameness or occasionally impaired motion of a joint, pain, atrophy of muscles with tenderness upon deep pressure at some point about the epiphyseal line, have a probable granuloma at such a point in the bone. Should there be a slight ridge or thickening here also, or a tuberculous heredity, the diagnosis is obvious. In these cases we employ two methods of treatment which have given equally satisfactory results: First: An incision down to the bone, separated by retractors and protected by wet gauze. A fine-tipped Paquelin cautery is then used to penetrate the bone by burning its way through; penetration is rapid after the cortex is passed, and one can readily tell if soft tissues are encountered in the bone. The bone cavity is then filled with iodoform powder, and the external wound closed without drainage. Second: To use a drill and gouge to locate and remove the disease, with similar treatment of the wound and closure. Where the disease has advanced to more pronounced destruction and there is an excess of fluid in the joint, we know of no treatment which has given such good results as the injection of iodoform emulsion, 10 per cent. in glycerin, into the synovial sac after expelling its contents by means of a trocar and cannula. This treatment was advanced by Billroth and Mikulicz in 1882, and has been advocated in this country by Senn. In the same manner balsam of Peru, carbolic acid, solutions of iodin and of formalin, iodoform in olive oil, and iodoform in ether have been used, but the glycerin mixture has given us the best results, possibly by reason of a special leukocytosis effect of the glycerin. This irritation, of more or less intensity, probably accounts for much of the benefit derived from this and other methods of injection or irrigation treatment.

We use no splint after injection, but seal the punctured wound and apply ordinary aseptic dressing, and in joints of the lower extremity patients are confined to bed about four days. There is considerable reaction during the first twenty-four hours, and severe pain, requiring morphin for its relief. The temperature at the end of from twenty-four to thirty hours usually rises from two to four degrees in favorable cases, and gradually lowers during the succeeding three or four days. We then urge the use of the joint, repeating the injection in two or three weeks, and in most cases secure a marked improvement in from two to four injections. Should there be rice bodies which obstruct the lumen of the cannula when evacuating the joint, or large collections of degenerative tissue, an incision may be made freely into the joint for their evacuation, or occasionally the joint may be flushed by a 3 per cent. boric acid solution before injection. If an incision is made, it should be closed securely without drainage, and the joint injected as before described. Favorable changes noticed at second or later injections are increased viscidity of the synovial fluid, becoming more mucoid and clear if previously turbid, and occasionally a joint will give the sensation of fluctuation without increase of fluid, a favorable change in the granulations forming permanent tissue.

There is a class of tuberculous joints characterized by great excess of peri-articular thickening—the stiff, doughy joint, without much fluid, which is not benefited by this or any other treatment other than excision or erasement.

The evacuation and injection treatment we apply in nearly all so-called cold abscess cases, especially those resulting from tuberculosis of the vertebræ, but the method is practically worthless in all cases of mixed infection or open sinuses, such cases requiring direct surgical relief by making freer drainage or complete removal of diseased tissue.

When inserting the trocar, the skin is drawn tight at the point of insertion, the trocar being passed for a space close beneath it before entering the cavity, to prevent leakage from the puncture and facilitate sealing. In children the primary infection varies according to the age and the joint, from ¼ to 1 dram of 10 per cent. emulsion being used, which, if well borne, may be increased at the next treatment.

Adults receive from ½ to 2 drams at the primary injection, increasing to 3 or 4 drams later. Zeller recommends the use of Bier's elastic band to produce congestive hyperemia in association with the iodoform treatment. DeVas claims as high as 72 per cent. of cures by the use of iodoform in oil.

During the past four years we have applied this method of treatment to 31 knee-joints, 12 wrist-, 11 ankle-, 6 elbow-, and 4 hip-joints.

Excisions.—We have secured the best and most useful results after excision of the elbow, next the knee, and, in order, the shoulder, hip, ankle, and wrist. There is one excision which has given such good results that I will call especial attention to it. This is known as Hueter's excision of the ankle, and is made by an anterior cut directly across the ankle in front down to the tendons; a catgut suture is passed through and back in each tendon and the nerve, applying forceps, two of a kind, to the ends of each suture, and different pattern of forceps to each cord; then, drawing up the loops of suture, the incision is continued through the tendons into the joint, which opens at once, and all the diseased tissues can be removed; by drawing on each similar pair of forceps, the tendons are at once properly approximated and the wound closed with drainage at the side.

OPEN TREATMENT OF SUPPURATION OF THE KNEE-JOINT *

WILLIAM J. MAYO

In the January, 1895, issue of the "Annals of Surgery," C. H. Mayo reported a case of acute suppuration of knee-joint which he had treated July 30, 1894, by a transverse incision across the front of the joint in the same manner as for excision. This procedure enables the surgeon to get at every part of the joint, converting its many recesses into a simple open cavity. The result of the operation is astonishing. In a few hours a patient in whom an amputation seemed to be the only hope is on the road to recovery; such treatment gives all the benefits of the mutilating operation without shock or injury to important structures. It must be understood that this method of treatment is for the more advanced cases, after the usual measures have been exhausted and amputation appears to be necessary. In most instances the capsule has been perforated, and the soft parts above and below the joint are infiltrated with septic material. All the important structures are in the popliteal space, and a transverse incision through the patella enables the surgeon to pack the joint with gauze and treat it as an open wound. By going through the patella secondary sutures are given a firm support after the infection is under control. The abscesses, if they exist in the soft parts, are freely opened and drained. The margins of the wound granulate rapidly, and in from two to three weeks, when the discharge has practically ceased, the cut patella is reunited, the excess of granulations removed, and the soft parts allowed to granulate.

Surprising to relate, not all the cases are followed by ankylosis. If the cartilage of the joint is not eroded, considerable motion

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* Reprinted from "Jour. Amer. Med. Assoc.," March 30, 1901, pp. 878, 879.

may be ultimately obtained, although this is a secondary consideration, as the condition is one which threatens life or limb. The reason ankylosis does not always follow is because the adhesions are developed in the same manner as a pannus projects over the cornea, and, unless the cartilage is completely covered by the advancing granulation, the portion which remains smooth permits of motion. If erosion of the cartilage has taken place, ankylosis will necessarily result, no matter what method of treatment is followed.

For the milder cases, in which the capsule is intact, irrigation with antiseptic solutions or with pure carbolic acid, followed by alcohol, as advocated by Phelps, is often all that is necessary. If this fails, lateral incisions, as practised by Halsted, or tubular drains, after the plan of Edmund Andrews, may be sufficient, but there are still a number of neglected cases, especially punctured wounds, in which these ordinarily satisfactory methods are entirely inadequate, and the patients have in the past come to amputation or death.

Open treatment by transverse incision across the entire front and lateral aspects of the joint gives all the benefits of amputation without its risks, and saves for the victim a most useful limb. We have practised this method for six years in a number of cases, with the most satisfactory results, and in children have obtained a range of motion of from 15 to 60 per cent. of the normal.

PRINCIPLES OF SURGERY

AN EFFECTIVE ASEPTIC DRESSING FOR ULCER OF THE LEG *

W. W. AND W. J. MAYO

Scrub the leg and foot with warm water and green soap, using a coarse hand-brush, the ulcer and its immediate vicinity receiving especial attention, being so thoroughly done as to remove all unhealthy tissues; this is painful, but usually well borne.

Rinse the leg with a solution of corrosive sublimate 1 : 2000, dry, and, placing the patient upon his back, elevate the limb. The ulcer is now filled with a paste of oxid of zinc and water; a compress twice the size of the ulcer, composed of a few thicknesses of gauze, is applied over it; this in turn is covered with rubber tissue, and the whole firmly strapped with adhesive straps to its place. This strapping should begin well below the ulcer, and, incircling the leg, shingle it to a point above the compress.

It is best to divide the strapping on the side opposite the ulcer, to prevent undue compression of the veins. If more than one ulcer be present, treat in a similar manner. A roller bandage 5 yards long and 3 inches wide is carefully applied from the toes to the knee, and over all a single plaster-of-Paris bandage of the same size.

This should be rather wet and well rubbed in. It prevents the dressing from becoming loose, excludes the air, and is not sufficiently stiff to prevent walking with comfort.

Advantages: First, each dressing can be left until the discharge works through, that is, from ten to twenty days. Second, one to three dressings are sufficient to effect a cure in the majority of cases. Third, the patient can pursue ordinary business with comfort.

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* Reprinted from "Northwestern Lancet," May 1, 1888.

This method has been used by us in many cases with the best of results.

The Martin bandage is always advised in the after-treatment to prevent a return.

Credit is due Lewis Pilcher for this idea of an aseptic dressing.

CANCER AND ITS SURGICAL TREATMENT*

WILLIAM J. MAYO

The subject of cancer is one which has occupied the attention of the medical profession from early time, and while vast clinical observation has crystallized certain prominent features into more or less definite facts, the great questions of cause and prevention are as yet unanswered. Still, it is worth our while to take an occasional inventory of new clinical experience and see if in any particular we can modify existing views.

When we have said that carcinoma, from a histologic standpoint, is an atypical new-formation, epithelial in type, and that it is local in origin, we have summed up about all our positive knowledge in regard to the nature of cancer.

Billroth adheres to the belief that cancer originates always from existing epithelial elements. Virchow, on the contrary, thinks that, under certain circumstances, it may be evolved from connective-tissue cells. The hypothesis of Cohnheim, which may be called that of "embryonic remains," leaves much to be desired, but is materially aided by his further suggestion of a change in the tissues which allows the invading cells to infiltrate healthy parts.

Creighton's supposition is that this negative resistance of tissues is due to a spermatic action of the diseased cells on the normal tissue, and that the resulting embryonic cells become an epithelial new-growth. Not one of these theories attempts to explain more than the facts as they are known to exist, and leaves the actual cause of the positive cell invasion and the lack of resistance in the normal tissues untouched. With the wonderful development of our knowledge of germs and the part played by them in the causation of disease there has been a growing suspicion that cancer has microbic origin, and the so-called "nesting of cells" has been supposed to be an effort on nature's part to encapsulate the growth. The analogy between the infective granulomata, such as tuberculosis and cancer, is sufficiently marked to have attracted attention to the possibility of a similar cause. Tuberculosis is far more common, yet far more curable, and inasmuch as it attacks by preference the weak and unhealthy young, we have the cold comfort, at least, of knowing that it often acts to the future betterment of the race.

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* Read before the Minnesota Academy of Medicine, February 3, 1892. Reprinted from the "Northwestern Lancet," March 1, 1892.

Cancer, on the contrary, attacks with special vigor people at the most useful time of life, and the most highly civilized races suffer with greatest frequency, the negro, for instance, being less subject to its ravages. Should cancer be caused by a germ, it is probably a facultative one, as it almost invariably destroys its host. Edmund Andrews suggests the idea of a germ whose natural habitat is in a fluid medium, and makes some interesting observations in this connection. The belief that the cancer germ may be an animal rather than a vegetable organism has been advanced, and numerous investigators have experimented along this line, notably William Russell, pathologist for the Royal Infirmary of Edinburgh. His conclusions, however, are not favorable to this view of the case. It can be said at this time that although Scheurlen and many others have discovered alleged cancer germs, no special microbe of cancer has developed. About four years ago Hall reported some remarkable cases in the "Annals of Surgery," illustrating a supposed contagious character to cancer, and outlined the germ theory. Such examples of apparent contagion are less frequent than those in which heredity has seemed an important factor. We must believe, however, that these unusual examples are a coincident rather than a positive element in causation.

An excellent review of hereditary influence as a cause of cancer may be found in Butlin "On Tumors." Age, care and anxiety, and the degeneration of scars and benign tumors, and, I might add, sex, from the excessive liability of the breast and uterus, all have a bearing on the phenomena of cancer. Injury has less significance than in sarcoma, but in chronic irritation we find a positive element which has stood the test of time, many types of cancer taking their names from the irritative cause. Spencer Wells, in the Morton lectures for 1889, expresses his firm conviction that cancerous diseases are on the increase in England, and Fordyce Barker and others are under the same impression as to our own country. Statistics, as pointed out by Billings in the Cartwright lecture for 1889, are of relative value only in settling this question, and often at a hasty glance give very erroneous impressions. For instance, accumulated vital statistics would show that the ratio of cancerous diseases to the 1000 was greater in the eastern States, while, as a matter of fact, the proportion of people of the cancerous age is relatively greater than in the new western States. Likewise, by means of statistics and a disordered imagination, the Anti-vaccination Society would attempt to show that vaccination was the cause of cancer. In a comprehensive paper on "The Cancer Problem," by J. H. Dunn, in November, 1890, he placed the general morality from cancer as about 10 per cent. of the total death-rate from forty to sixty years of age, and I think that this is not an overstatement.

From this brief review it is evident that our knowledge of the nature of cancer is largely clinical, and as much may be said in regard to the means of diagnosis. The microscopic examination of the tumor, where full opportunity to make sections can be had, furnishes positive evidence, but this cannot be said of its testimony where the examination has been made of a small piece from the surface or harpooned from the tumor; under such circumstances less reliance can be placed on it.

The question of malignancy would be sufficient alone for an evening's discussion; in passing, it may be said that, from a pathologic standpoint, the more embryonic the cells and more widely differentiated from the normal structure of the part, the more malignant. From a clinical point of view the anatomic site, the consistence, as hard or soft, the condition of the surrounding parts, brawny and inflammatory, or free from infiltration, all suggest themselves to our minds and influence our prognosis. In the improved prognosis of cancer after operation, however, I believe modern surgery can be justly proud. Confidence in the local origin of the disease and our improved wound treatment have permitted radical removal in a large and increasing number of cases. The primary mortality has gradually decreased, and recurrence has been much less frequent. Before the Surgical Section of the American Medical Association, some five years ago, Briggs, of Tennessee, said that, in over 300 cases in which he had amputated the breast for cancer, scarcely one lived over the three years' limit without recurrence. Compare this statement with that of Frederic S. Dennis before the American Surgical Association in 1891, in which he gives a careful analysis of nearly 80 radical operations for breast cancer, with more than 30 per cent. free from recurrence at the end of three years. Dennis makes this significant statement, that "the return of cancer within three years is a continuance, not a recurrence"; in other words, that it was not completely removed. After three years it was probably a new-growth due to the same original causes.

The frequency of carcinoma in different organs of the body varies in different countries: France gives first place to the stomach; England and the United States, to the uterus. For the purpose of comparison it may be said that five-sixths of all cases can be placed in four nearly equal groups: First, face, including lips, tongue, and mouth; second, breast; third, uterus; fourth, stomach.

Theoretically, cancers of the face and lips, from their external situation, allowing early diagnosis and prompt removal, should give the best results, and this we all know to be a fact, at least 50 per cent. making a permanent recovery. In operations about the face and mouth the anesthetic is often a source of vexation and delay. We have succeeded best by a preliminary hypodermic injection of morphin and profound etherization before making any attempts at operating. This single combined anesthesia will often carry an operation to its completion. The tendency of the blood to gravitate into the throat and interfere with respiration may be met by having the patient strapped to a chair, which can be raised to a sitting position only during actual working time. Any tendency to syncope necessitates prompt dropping of the chair. In removal of the tongue this position has given us great satisfaction. The method of operating with the patient's head hyperextended, as off the end of a table, is most useful where it is necessary to operate on the hard palate. In the more formidable operations about the mouth it is undoubtedly better to make a preliminary tracheotomy and insert a tampon cannula. To prevent annoyance from the patient's hands tie them securely, and to preserve a clean wound give no food by the stomach for at least twelve hours previous to operation and several days after, supporting the patient by nutritive enemata.

A radical operation for cancer of the breast demands in every instance the removal of the axillary contents, and I believe this will become the general rule of surgical practice. I have removed the cancerous breast over 30 times, and in my earlier operations cleaned out the axilla only if enlarged glands could be felt, and in nearly every instance, where left, I was compelled to remove them at a second operation. During the past six years I have made the complete operation over 20 times, removing the axillary contents whether any enlargement could be felt or not, and have been surprised how uniformly changes in the glands have been discovered where no suspicion of enlargement could be felt previous to removal. Many of these operations are of too recent date to be called cured, yet the percentage of non-recurrence at the end of three years is more than double the percentage of my former series.

In regard to the objection of increased primary mortality I can only say that the mortality in cases suitable for radical operation will be small. All my patients have recovered from the operation, and by observing the two rules of Langenbeck in the removal of tumors, to separate the tumor from the large vessels first, and to tie the pedicles of deep-seated growths, much time and loss of blood can be saved. As a means of readily finding the axillary vein, I have found it best to open the deep axillary fascia just at the edge of the pectoral muscle, and separate the cellular tissue, when the vein will at once come into view. In one instance of intimate adhesion of a diseased gland to the vein I was compelled to tie in a considerable lateral portion of the vein, with an excellent result. John Chiene says that after removing a breast or other part for cancer he washes it free from blood and drops it into a 5 per cent. solution of nitric acid while removing the axillary contents. In ten minutes, if any cancerous change has gone beyond the incision, such spots turn white and hard at the infected point, readily indicating where further removal is necessary. I cannot overestimate the great practical value of this test.

It has been my experience to meet with but few cases of cancer of the uterus which I considered suitable for radical operation. In such cases vaginal hysterectomy must yield better results than the high amputation of Baker. The rule of Gross, that the whole of an organ should be removed in malignant disease of a part, must hold good here as elsewhere. Baker claims 50 per cent. of cures at the end of three years, with a mortality of less than 5 per cent. Vaginal hysterectomy has a mortality of 10 per cent., with 25 per cent. free from recurrence. This apparent proof for the former is, in my opinion, counterbalanced by the fact that only the more severe cases have been subjected to the latter operation. The one difficulty in the way of radical operation is that the disease has so frequently passed beyond the possibility of cure before the surgeon is consulted.

Cancer of the stomach presents so many inherent difficulties in the way of diagnosis and operation for radical cure that I may say that triumphs are surgical curiosities. In two instances of cancer of the stomach I have made exploratory incisions, and, with the exception of sufficient manipulation to make a diagnosis and free irrigation, have done nothing, yet in both instances marked improvement was manifested, one patient gaining over 20 pounds in weight, the tumor reducing more than one-half in size, and fair health regained for a year. At the earnest solicitation of this patient I repeated the incision and irrigation after the tumor again began to enlarge rapidly, but it had no effect, and he died a month later. As to the reasons for the improvement after such negative operations, I will refer you to the paper of J. W. White in late numbers of the "Annals of Surgery."

I wish to draw a well-marked line between operations with a view to radical cure and purely palliative ones. Formidable operations with a high primary mortality, of almost hopeless prognosis as to ultimate results, are an injury to our art. It deters the timid from early interference and drives many to the cancer quacks. True palliative operations must have a low mortality. The great relief afforded to a suffering woman by the simple and safe cureting of an advanced cancer of the womb is genuine palliation. Yet these principles are too seldom applied to advanced cancer of other regions. In no domain of surgery have I given greater relief to human suffering than by the thorough cureting of a fungating or ulcerating tumor, followed by the cautery and iodoform gauze pack. Colotomy for advanced cancer of the rectum is an operation that not only palliates, but actually prolongs life, and such procedure, combined, where possible, with the cureting and cauterization of the mass, will give comfortable existence for months. The late diagnosis in rectal disease, like that of the uterus, does not often permit of radical operation, even after the method of Kraske. In palliation of cancer of the stomach and intestines Senn advocates anastomosis by means of bone-plates. His results in 13 cases recently reported give too large a primary mortality to render it popular at the present time. The use of drugs and electricity is worse than useless, killing valuable time until the disease kills the patient. Erysipelas as a complication in patients suffering from cancer has in a few instances cured the disease. I have seen one such case. This has led to extensive inoculation with cultures of this microbe; on the whole, the results, as given by Senn in his late work, and by Roswell Park in his lectures before the Philadelphia College of Physicians, are not encouraging.

Let us hope that the known affinity of the anilin dyes for cancerous tissue will prove of value. In this respect there is a striking similarity in the reaction of germs to the same agents. During a recent visit to New York I witnessed some interesting experiments by Robert Morris with methylene-blue upon inoperable cancer. A 1 : 500 aqueous solution was employed both by hypodermic and by intravenous injection. In one instance 12 ounces of this solution was introduced into the median basilic vein, sufficient to turn the blood a brownish hue when drawn for examination within an hour. In several cases the tumor became distinctly blue and there was apparent benefit. Before leaving this subject I wish to call your attention to the necessity for repeated operation upon the slightest return of the disease. One patient I have operated on 6 times within eight years, and the last time nearly two years ago; she is now free from recurrence. Another I operated upon three times within two years and she is free from recurrence now nearly four years.

I tell my patients that they must return at short intervals for examination, and, after explaining the consequences of failure to do so, I have found ready obedience.

A CONSIDERATION OF SOME OF THE PRINCIPLES UNDERLYING THE SURGICAL TREATMENT OF SUPPURATION *

WILLIAM J. MAYO

Suppuration is a condition resulting from many and often diverse processes, which must be properly qualified in order to give exact information. Shattuck has proposed the word "pyosis," to distinguish the pus produced by the so-called pyogenic bacteria, while Park suggests the term "puruloid," to designate the variety due to the tubercle bacillus. If the word suppuration could be limited to the results of the ordinary pyogenic microörganisms, much confusion would be avoided.

Theoretically, it cannot be denied that suppuration may be produced without bacteria, but from a practical standpoint the bacteria are always the exciting agents. Pathogenic bacteria are divided by Tillman into two general classes: first, the toxic, which act upon dead tissue, causing a toxin in the nature of a chemical poison; second, the infections due to microörganisms capable of developing and spreading in the living tissues, and it is to this class that suppuration is largely due. The process of pus formation is to a great extent modified by the particular kind of bacteria which are responsible for its development, and when not otherwise stated, it may be taken for granted that the active agent is one or more varieties of the so-called pyogenic group, of which the staphylococcus and streptococcus are the most prominent members, and many others are prolific causes of infection.

A large number of acute abscesses exhibit a variety of bacteria, the accurate observations of Dowd, in the Vanderbilt clinic, being of great interest in this respect.

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* Reprinted from the "Northwestern Lancet," March 1, 1896, vol. xvi, pp. 82–86.

Warren calls attention to the peptonizing action of the staphylococcus, which causes a ready liquefaction of the inflamed tissues into a local abscess. Since, under such circumstances, the germ is not ordinarily long lived, this form of infection is less formidable than the more resistant streptococcus, which has much greater invasive tendency, but with far less power to soften the area of coagulation necrosis into pus.

The grafting of a streptococcus upon a staphylococcus infection would give a spreading character to the inflammation and render it more obstinate, while adding the staphylococcus to the extensive infiltration of the streptococcus would cause a rapid melting of the infected tissues and great additional damage. This is seen not infrequently in an infection of the hand extending along the lymphatics of either the flexor or extensor surface of the arm as a cellulitis. If purely streptococcus, it may disappear with little or no pus formation, like an erysipelas, but if the infection be mixed, most extensive sloughing follows. The pneumococcus of Fränkel is an important pus-producer of the least virulent type, particularly common as a cause of suppurations in the pleural cavity, and at times in the joints and other portions of the body. Its life-history is short and resistance slight, which renders nature best able to cope with its manifestations. The gonococcus of Neisser is capable of producing pus, and is often extremely resistant, reappearing under suitable excitants months after supposed cure. The extravagant claims of Noeggerath have not been wholly substantiated, yet it is undoubtedly a frequent cause of pelvic suppuration in women.

The Bacillus coli communis is a pus-producer particularly common in abdominal and genito-urinary suppurations. Welch comments on its penetration and its great resistance, as factors which give it undue prominence. He says that it is more often a secondary invader, although it may be the only one found upon examination, the exciting agent having disappeared.

In rare instances the typhoid bacillus of Eberth may be a cause of late suppuration of an obstinate character, and many cases have been described. Parsons, of Johns Hopkins Hospital, reports 6 cases of bone disease due to it, and I have seen one involving the ribs from this cause.

Chronic suppuration is usually tuberculous in character, although it may be due to syphilis, glanders, actinomycosis, or to an attenuated pus-microbe of the common varieties.

The cold abscess of tuberculosis was well understood in a clinical way long before the specific nature of the cause had been discovered, and the opening of such collections of purulent débris was looked upon with great disfavor, due to the resultant mixed infection and its attendant dangers.

Welch says that a given bacteria of great virulence cannot be told botanically from one of the same class having slight powers of infection. A streptococcus from an erysipelas under the microscope is not different in appearance from a streptococcus capable of causing but the mildest form of inflammation, and while the microscope and culture tube are essential to a correct diagnosis of the germ variety, yet much can be learned from a careful clinical examination. The importance of aseptic operation and after-care of any form of suppuration is at once manifest. The necessity of most thorough work in the treatment of suppuration due to a mixed streptococcus infection is self-evident, while a pneumococcus or tuberculous suppuration should be as carefully managed as a clean wound.

Variations in the Phenomena of Suppuration Due to the General or Local Condition of the Patient.—Immunity from the action of pathologic germs is a phenomenon which is acknowledged by Welch to be imperfectly understood, and the assertion of Fränkel, that it is a combined rather than a single process, is undoubtedly correct. Following the lines laid out by Koch, various attempts have been made to produce immunity by means of sterilized attenuated bacterial cultures. Roux and Kromacher have found that such cultures of the staphylococcus temporarily act to protect the organism from the action of the pyogenic bacteria, while others claim to have discovered a serum capable of curing the infection of streptococcus.

Immunity to certain germs has been definitely shown, and instances of acquired protection from the action of bacteria, through the agency or presence of previous infection, are well known. Just how nature accomplishes the destruction of infections is a disputed point. Ernst gives the weight of his authority in favor of the theory of phagocytosis, as elaborated by Metchnikoff, and, undoubtedly, it is of the first importance. The "inflammatory leukocytosis" of Tillmanns is, without doubt, a part of the same process. The humoral theory of immunity, as evolved by Buchner and other pathologists, demonstrates the bactericide properties of the blood-serum, and Vaughan endeavors to show that this defensive action is due to the development of nucleins. A careful investigation of these theories of immunity will convince one that they are all part and parcel of the same process, and remind us of the arguments between the two schools of pathologists a few years ago, as to whether it was the germs or their toxins which caused the disease. Councilman divides the conditions which interfere with nature's defense against infective inflammations into two classes—general and local. Among the general conditions, arteriosclerosis and cardiac insufficiency need but be named to show their relation.

Disease of the kidneys, by interference with the elimination of germs and their toxic products, is a factor of the utmost importance. Diabetes mellitus, syphilis, hemophilia, and scurvy are all prolific causes of interference with the germicide properties of the body, while autoinfection from the intestinal tract is of vast importance, particularly in abdominal surgery. Local changes, such as traumatism or edema, may tend to prevent the ready healing of a suppuration. An infection in a highly vascular part would be less productive of mischief than in a part less supplied with nutrition. A suppurating wound is an unfavorable soil for infection, although it not infrequently takes place; but the bactericide properties of the pus itself, and the protection afforded by the granulations, render such a surface highly resistant. This, however, would not hold good where there was a lack of free drainage, particularly in the presence of saprophytic organisms and their resultant changes in the character of the toxins of suppuration.

The Element of Time as Affecting Suppuration.—Time affects both the seed and the soil. Many of the less resistant pyogenic organisms die a natural death, or fall an easy prey to nature's efforts at repair, and this is particularly true of well-walled abscesses; an acute pyosalpinx may be highly infectious; an old one of very slight or no such power.

In a paper on "Vaginal Section and Drainage," by A. W. Abbott, in the "Northwestern Lancet," December 15, 1895, the question of vaginal drainage of suppuration in and about the tubes was ably presented; and in acute infections this is undoubtedly a correct principle. But in chronic cases the thorough removal of pus-tubes, as practised by Price, is much better surgery. In the appendicular abscess self-sterilization is not so commonly attained, because of the long life and high resistance of the coli communis, which is so frequently a primary or secondary invader. For this reason an abscess involving the appendix should not be disturbed more than to furnish free drainage; otherwise general infection may supervene. The presence of suppuration in the body for a long time greatly increases the power of resistance to its manifestations. The constant absorption of bacterial products acts in a general way as a continuous inoculation, and for the time increases the bodily immunity. In a general way the patient can be said to have gotten used to it. We see this in the attenuation of the invading bacteria in a discharging pyogenic focus and the increasing resistance of the tissues. Operations in the presence of an old suppuration are usually followed by good results, but in the presence of acute infections the danger is largely increased.

Another interesting feature of suppuration in this regard is the question of latency. The fixed debate in December, 1895, of the London Medico-Chirurgical Society, upon this question was of great interest. Hutchinson called particular attention to the fact that a long period of latency might be followed by a fresh outbreak, which would often erroneously be thought a new infection. This is particularly true of the tubercle bacillus, the streptococcus, and the gonococcus. Washburn attempted to explain that the antitoxins of the body for a time neutralized the toxones of the infection, but lacked the bactericide ability to kill them outright. This is shown in the old bone abscesses existing for years. I operated in one case during an exacerbation, after forty-six years of latency.

A failure on nature's part to overcome a prolonged suppurative inflammation is shown by degenerative changes in the vital organs concerned in the production of immunity and elimination—amyloid disease most marked in the liver and kidneys.

The Nature of the Infected Tissues and Their Immediate Surroundings as Influencing the Treatment.—Suppurations involving the superficial tissues of the body are of importance not only on their own account, but also by reason of their connection with important structures, which may become secondarily involved. Suppurations about the head, especially in the neighborhood of the auditory apparatus, because of the emissary veins, may be the means of carrying an infection to within the cranial cavity. The relations of the deep cervical fascia of the neck with the anterior mediastinum should be borne in mind. Surgical kidney, as an extension of a urethral or bladder inflammation, and pelvic suppuration resulting from an endometritis, are also common examples. Suppurative inflammation of the serous membranes has been closely studied. Involving the meninges, it is almost uniformly fatal, and, for obvious reasons, difficult of exact bacteriologic diagnosis. Lumbar aspiration of the subarachnoid space, advocated by Jacoby, may be of assistance in this respect.

The able paper by J. H. Dunn, published in the "Northwestern Lancet," January 1, 1896, on "Purulent Pleurisies," covers the ground so completely as to render it unnecessary for me to do more than emphasize his remarks on the value of taking into consideration the bacterial cause in the treatment, and the vital difference between the indications furnished by the suppuration resulting from the pneumococcus and that of the streptococcus.

The weak points in nature's peritoneal protection are the appendix, the gall-bladder, and the Fallopian tubes in women. The appendix communicates with the large intestine, which has a slow current, and contains the most infectious and resistant of germs; while the nature of the constantly moving small intestine, which must so largely enter into the confining wall of an abscess, renders adhesion uncertain and the danger great.

The gall-bladder indirectly connects with the duodenum, where the current is more rapid and the common bacteria present are not usually of a high degree of virulence, while the fixed position of the liver and the proximity of the transverse colon render adhesive protection more ready; therefore the milder grades of infection predominate. The Fallopian tube lies among organs more or less fixed, has also the aid of gravity, and needs but a roof, which is largely furnished by the non-active colon and the omentum; while the infective germs common to the tract of which it forms a part are not of a nature to spread with great rapidity, nor are they resistant to nature's efforts to encapsulate. Suppurations in joints, by reason of their being in intimate association with the lymphatic spaces, have great danger and are of unusual interest. Here again the nature of the invading bacteria is of vital importance. When due to the pneumococcus, even motion may be obtained by proper non-mutilating means.

A mixed streptococcus infection of the joints requires the most thorough drainage. Free transverse anterior incision for treatment of the knee-joint originated by C. H. Mayo has proved a most satisfactory method.

Suppuration in bone, on account of the nature of the tissue involved, illustrates the evil effects of tension. The most common bacterial invader in the bone is the staphylococcus, and because of its tendency to produce a local abscess becomes at once most destructive.

The Treatment of Suppuration.—From personal experience I am convinced there is too much meddlesome treatment of suppurative wounds and cavities. Our observation has been that free drainage, and all that it implies, with rest and protection from further contamination, gives the best results. The irrigation of wounds, either with plain or antiseptic solutions, is apt to dilute the pus, rendering it more easily absorbed, and also to destroy its bactericidal properties. It disturbs nature's protective barrier, and is often followed by reactive inflammation.

In certain cases where saprophytes are present it may do good by washing away the culture-medium, or render more fluid pus too thick to drain, but its field of usefulness is small. Peroxid of hydrogen has a fascinating action, and, if inefficient drainage exists, may be useful. Its routine employment does not amount to much. There are many advocates of the dry treatment of suppurating wounds, and in our hands it has given the best satisfaction, especially in *chronic* suppuration after the whole infected neighborhood has been freely exposed. This method has been advocated of late as the aseptic treatment of suppuration by Zeidler and others. Taken as a whole, I believe that this method should be the routine practice, and the antiseptic treatment used only when particularly indicated. Wet dressings are of great value in the treatment of *acute* suppuration, and while a weak antiseptic solution may not have any power upon the suppuration itself, it certainly renders the discharges less infectious, and more thoroughly prevents ingress of other bacteria than the salt solution of the aseptic treatment.

The value of turpentine in bone suppuration was pointed out by Banks, of Liverpool, and certainly to clean a foul wound of any kind from crusts and to stimulate granulations it has no superior.

Ochsner has called attention to the great value of compound tincture of iodin in the stimulation of old suppurative sinuses, particularly mixed tuberculous infection. Either pure or diluted, it is unsurpassed as a stimulating antiseptic. For unmixed tuberculous suppuration the iodoform emulsion treatment advocated by Senn is an important aid, and the resulting reactive swelling, when absorbed, contains some chemical compound which acts favorably upon the body, as a whole, in a remarkable degree. In the presence of mixed infection it is wholly ineffective.

THE PRELIMINARY EXAMINATION OF SURGICAL PATIENTS *

WILLIAM J. MAYO

Paget says that every patient should be as carefully examined before operation as for life insurance, and that this examination will often reveal contraindications of vital importance to a procedure which might otherwise be for the best interest of the patient.

Operations of necessity, *e. g.*, the relief of traumatisms, malignant disease, and later results of infections, formed the bulk of the work of the clinical surgeons in days gone by; then, as now, the urgency of the case demanded attention without regard to the surrounding conditions.

Operations of expediency, which today supply the great body of our clinical material, are entirely different in their nature and conception, since they are done for the relief of conditions which may not prove fatal, but with the idea of rendering life more comfortable and useful. Maximum good results with minimum risks are, therefore, demanded.

Very frequently our failures do not lie in the operation itself, nor in our inability to meet the indications, but rather to the fact that we have overlooked some element in the personal examination of the patient; that he was a hemophiliac, had chronic interstitial nephritis, or an acute bronchitis. That the operation was a success, but that the patient died from other troubles does not help us out. Unfortunate experiences of this character, days of anxiety, and final disappointments have convinced me of the absolute necessity of a more thorough preliminary examination in fitting the operation to the patient, not to overtax his vital resistance nor overlook contraindications.

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* Reprinted from the "Northwestern Lancet," 1897, vol. xvii.

In the face of grave danger no conscientious surgeon would fail to give his patient the benefit of an operation, yet with how little conscience do we sometimes subject our patient to imminent danger of life by examining the surgical indications only and leaving the general condition to chance. A thorough understanding of the vital resistance of the patient may contribute as much to the good results as the much more studied technic of the operation.

The majority of our surgical patients can be examined as to their general fitness for operation with little loss of time, but patients who differ much from the ordinary standard require more careful examination. Extremes in size, either very large or very small people, or people who are excessively fat, not only render operation more difficult, but often are less resistant to infections and necessitate more than ordinary care.

Nationality undoubtedly has some relation to vital resistance, and this should be borne in mind in connection with the examination and treatment of patients of foreign birth. The more ancient the civilization, the greater the resistance to obligate microörganisms. This is less true as to facultative bacteria. Many races of people have acquired a considerable degree of immunity from diseases common to their locality, and the greater variation between this hereditary environment and the new surroundings, the less the resistance. Other things being equal, age bears operation better than infancy. Women bear operations better than men. Chronic alcoholics bear anesthetics badly; morphin hypodermically administered and chloroform anesthesia best control the muscular tremors so hard to subdue, and I believe are less apt to produce traumatic delirium tremens.

Many people apparently extremely robust, but of phlegmatic temperament, do well after operation to a certain point, but the line of apparent favorable progress and imminent danger is a narrow one; let that line be crossed, and they seem to have no power of recuperation. People of very nervous habits most often exhibit wonderful powers of resistance.

In my own experience, unexpected danger has appeared most frequently in the lungs, although the heart or kidneys may primarily be at fault, and this has often come through the anesthetic. I now practise giving the anesthetic only when the preparations for operation are complete, and always in the operating-room, not in an adjoining room of different temperature. This has been a rule to which patients have objected much less than would be thought. The body and chest should be carefully protected with flannel throughout the operation; ether is not given in acute colds, bronchitis with free excretion, etc. Chronic tuberculous processes in the lungs, if not accompanied by profuse expectoration, do not contraindicate ether. I have noted in such cases subjected to operation for other conditions a gain greater than would be expected from the local result of the operation itself. Bier has shown that chronic congestion of joints artificially produced, like chronic pulmonary congestions, are unfavorable to the growth of the tubercle bacillus. Perhaps ether may act in the same way. Chronic tuberculosis often seems to be greatly benefited by the removal of the primary focus of disease, although this local focus may of itself be comparatively unimportant.

A patient with valvular disease of the heart, if not too extensive, and providing the compensation be good, will usually bear operation well. Ether is the preferable anesthetic. Fleshy people with tendency to feeble circulation, the heart's action indistinct, with evidences of venous congestion, are to be avoided as surgical cases when possible. They have a marked tendency to develop pulmonary congestion and bronchopneumonia. High arterial tension most frequently results from kidney disease, and chloroform is the best anesthetic. Almost all cases of heart disease are benefited by a hypodermic of morphin preliminary to the anesthesia.

Routine examinations of the urine should be made before operation. Urine may contain albumin and casts, yet if the specific gravity is not low and the urine normal in quantity and with normal urea, operation may be performed with comparative safety. Many of the worst cases of kidney disease from a surgical standpoint may not show albumin or casts in the urine. We should always be suspicious of low specific gravity when not due to nervous conditions, and especially so if this is accompanied by high arterial tension and polyuria. Under such circumstances the urine should be saved for twenty-four hours to give the total amount. If possible, sediment should be secured by the centrifuge and examined for casts. Careful examination of doubtful urine for urea is more important than testing for albumin. These cases of cirrhotic kidney often appear very well, and even to the most expert show little signs of disease; but shortly after operation albumin, scanty urine, and uremia may appear, with fatal results. In any case of doubtful kidney the catheter should be avoided after operation, on account of the extreme danger of infecting the crippled urinary tract. All patients of this variety should be induced to pass their urine in a recumbent position for some days before operation, as advocated by Fränkel. It can be fairly definitely stated that chloroform and ether act about the same on the healthy kidney, but on the diseased kidney chloroform is less harmful.

As a prerequisite to operation upon the alimentary canal, the necessity for removing all excrementitious substances is universally recognized. At times it is impossible to get the bowels to act freely without delay. If the abdomen is tympanitic and the case is not urgent, I prefer to wait until this condition can be removed, which will tend to shorten the convalescence more than the days of waiting. Personally, I have not found it best to interfere for several days before operation with the ordinary form of diet to which the individual is accustomed, as practised by many. It may be best to exclude many articles of an irritating nature, but it is a bad time to introduce dietetic fads. For some hours after operation digestion is delayed, and for this reason it is not wise to allow food to be taken immediately before operation.

It has long been a clinical observation that certain individuals possess more or less immunity to the action of infectious diseases, and that this vital resistance varies greatly in the same individual under different circumstances. This resistance was noted to be either hereditary or acquired, and that certain blood disorders, as scurvy, diabetes, etc., would to a great extent modify or break it down. Just how immunity was brought about was not explained until Metchnikoff disclosed his theory of phagocytosis, and his observations have in the main been proved correct by indisputable evidence derived from animal experimentation in the hands of many observers. Buchner and his followers developed the humoral theory, but it is evident that this is part and parcel of the same process.

Pfeiffer, studying the attraction and repulsion of animal and vegetable cells under the term of "chemotaxis," describes the manner in which, through inherited tendencies, cells are more or less attracted to invading microörganisms, and the activity of this chemotaxis tells the story as to the way in which immunity is produced. Phagocytosis is not confined to the corpuscular elements of the blood, but it is also participated in by the tissue-cells.

Many prominent features of the functions of the red corpuscles have long been understood, while the so-called third corpuscle, or blood plaque, is too little developed for practical working at this time. Investigations as to the functions of the leukocytes have produced much of practical utility. Leukocytosis as an indication of nature's methods of defense to the invasion of certain microörganisms is an important element in diagnosis, especially in concealed pus-formation. The observations of Roswell Park that the abscess of appendicitis could be diagnosed by the presence of this condition has proved to be a valuable indication. Christopher Graham has made a number of examinations of the leukocytosis of pus-formation, and believes it to be a reliable sign. Cabot has pointed out that pneumonia without leukocytosis is liable to be fatal, and he also develops testimony as to its presence in malignant tumors of rapid growth. Experimental evidence shows that each variety of leukocyte has some peculiar inherited function in nature's defense, and we may look for much information as to the value of changes from the normal standard. In diseased conditions not only are there variations from the normal, but entirely new forms of leukocytes appear.

I will not enter into an extended discussion of this particular topic, but it is my conviction that the study of the blood as a part of the preliminary examination of surgical cases will soon be as routine as the examinations of the urine. The vast importance of the so-called "condition of the blood" cannot be overestimated. We shall hail with delight the prospect of scientific accuracy which is now expanding so rapidly under the methods of modern research.

To those interested in this subject, the contributions of Roswell Park on the "Surgical Pathology of the Blood," and of Cabot, on "Blood Examinations," will prove of great interest.

HEAT IN SURGERY *

CHARLES H. MAYO

Heat as applied to surgery must be nearly or quite as ancient as the art itself. For ages it was the one yet unconsciously employed principle of asepsis, it being beyond question the chief of all sterilizing agents. In the shape of hot air, hot water, steam, and various forms of the actual cautery it is now used for the relief of many troubles, and surgical inventors vie with each other in the construction of more or less useful instruments for its application. The instruments commonly used are the electrocautery, Paquelin, cautery irons, spirit-lamp, and hot-awls.

Carbuncle.—One of the most serious of infective diseases is carbuncle. It is usually caused by the Staphylococcus pyogenes aureus and albus, and in the severe cases death is not an infrequent termination. A variety of treatment is directed to the support of the patient, to prevent extension of the disease, shorten its course, and relieve pain. External applications, injections of acid into the tumor, crucial incisions, cureting, and, finally, total excision, all have their advocates, yet theoretically and practically nothing can compare to the total destruction of the disease with the actual cautery. The wound is filled with boric-acid powder and left several days until the dressing becomes moist, when a daily dressing of naphtholin or some other antiseptic ointment is applied. Absorption is checked and the temperature drops at once, the heat starts an aseptic slough, tension is relieved, and the pain ceases. When granulations appear, skin-grafting will hasten the final recovery.

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* Read before the Minnesota Academy of Medicine, February 6, 1901. Reprinted from "The St. Paul Medical Journal," March, 1901.

Nevus.—The familiar forms of nevi are the simple, mulberry, and cavernous. Their size, location, and the age of the patient must be considered in regard to the method of treatment employed—whether we will make a clean incision, use electrolysis or heat. Swiftly drawing the flat cautery at a good heat over simple nevi, making a burn of the first or second degree, will often cause sufficient contraction of the superficial capillaries to improve the appearance of the mark. These cases are seldom satisfied with any condition short of perfect, and, as a rule, electrolysis is the best method.

The progressive nevi of cavernous or mulberry type, so commonly seen upon the nose or near the eye in young children, often become a serious condition, and early attention should always be advised. Their excision may prove a dangerous procedure because of the anesthetic, loss of blood, or shock. To prevent hemorrhage, the sutures are often drawn tightly, causing a slough, and leaving an ugly scar or bad coaptation of natural lines. Nevi of this description are best treated by repeated ignipunctures all about the periphery of the growth. The punctures are directed beneath the area involved, and made about one-fourth inch apart, large nevi often requiring a few punctures through the surface to blanch the tissue. Severe cases may require two or three operations at various times to complete the contraction of the vessels, care being taken to destroy as little of the normal skin as possible. The applications are best made with the electrocautery or the small point Paquelin. A heated brad-awl answers every purpose. A few cases will require a cosmetic operation later for the removal of the scar.

Malignant Disease.—As a preliminary step in the removal of ulcerating cancer, a local sterilization is accomplished by means of the cautery.

In vaginal hysterectomy the cautery should be used in incising the vaginal mucous membrane, also in separating the uterus from the ligatures or clamps, as it checks the bleeding, which obscures the field, and prevents inoculation of the wound with the malignant process. Up to the present time the ultimate results of vaginal hysterectomy for malignant disease of the uterus have not equaled the unchallenged statistics of Byrnes in regard to high amputation of the cervix by means of the electrocautery.

Fungating or cauliflower cancer of the uterus in a stage too advanced for total hysterectomy has been treated by cureting and cauterization, to which has been added, in the last few years, the insertion of carbid of calcium in the excavated area. This combination in hopeless cases cleanses the parts, reduces the odor, checks hemorrhage, and prolongs life. In many cases the palliation is marvelous.

In our experience two cases which were considered beyond radical cure showed a remarkable improvement, the fixation, which had been considered cancerous infiltration after the palliative operation outlined above, disappeared, the uterus became movable, the loss of blood stopped, the patients gained in strength, and in a few weeks were able to withstand the successful removal of the uterus by the abdominal route. Both are well now, more than two years after operation, and give promise of ultimate cure.

In carcinomata in other situations the actual cautery is often the best agent; this is particularly true of the ulcerating types in which there is a surrounding inflammatory zone. If these cases are operated upon with the knife, a rapid return often follows, but if thoroughly charred with a red-hot iron and packed full of dry boric acid, granulation may be expected, and with secondary skin-grafting large surface defects may be covered. As a palliation in hopeless malignant disease of the ulcerating type thorough cureting, followed by the hot iron and dry boric-acid powder, will quickly check the bleeding and discharge and leave a comparatively healthy granulating wound. After operation for malignant disease the use of the cautery adds greatly to the safety and does not prevent prompt healing nor require drainage.

Tuberculosis of Bone and Joints.—Tuberculosis of bone, which occurs most frequently in the epiphyseal ends of the long bones, shows itself at an early period by localized pain or joint tenderness, or there may be effusion or impaired motion, and a tender point about the epiphyseal lines adjacent to the joint affected. In such cases an incision is made down to the bone at the point of tenderness, and after separation and protection of the soft parts the bone is penetrated by means of the small point of the Paquelin at a red heat. In some instances a cavity will be found which will be fully sterilized by the heat. The bone cavity is now filled with iodoform and glycerin, and the soft parts closed without drainage. This treatment substitutes a reparative process for a destructive one.

Lupus is best treated by excision and closure of the wound by sutures or skin-grafting. The same result can be accomplished by the cautery and secondary skin-grafting in suitable cases.

Neurasthenic Joints.—Slight injuries about joints often produce severe disability, extending over a long period and far out of proportion to the injury itself. Such patients are neurasthenic or hysteric, and it is a common practice to combine mild scarification by the actual cautery with more or less suggestion. Some of the chronic cases of sciatica may be relieved in the same manner, and it is very useful, as a burn of the first degree, following the course of an inflamed and painful nerve from any cause.

Hemorrhoids.—The Smith operation of clamp and cautery for hemorrhoids is probably the one most frequently employed. This operation, when properly executed, is one of the most satisfactory in surgery. The technic of the operation I shall describe is somewhat different from that of most operators, for, having employed it in over 300 cases, we can thoroughly recommend the method. The evening before the operation the patient is given one ounce of castor oil; in the morning he receives an enema. Under general anesthesia the anus is thoroughly stretched and the rectum cleansed. Forceps are attached to each hemorrhoid, the pile clamps are applied, and the pile is burned evenly and slowly down to a solid button above the bite of the clamp (baked would probably be a more expressive term), never burning off smoothly along the clamp, and never cutting off a pile with scissors previous to burning, although the skin may be cut to the subcutaneous tissue if involved. The small soldering irons are found to be the best for the purpose. Usually three groups of vessels need to be destroyed, anteriorly and laterally, and with a little practice all the hemorrhoids can be grasped and included in three eschars. To prevent future contraction at least three separate one-half inches of mucous membrane in normal condition should line the anal opening. No more than four large piles, as a rule, should be removed by this method. If there be other small piles between, they can be punctured with the small point cautery. The surrounding parts are protected from excessive heat or accidental slipping of the iron by a square of asbestos cloth with a cut in one side, to allow it to slip beneath the clamp. A little vaselin is applied to the anus on gauze, and the patient put to bed. No tube or pack is inserted into the rectum; the operator who employs them has had reason to fear hemorrhage, which is an occasional occurrence where the tops of the piles are cut away before cauterization, or when they are not all marked at first with forceps, necessitating search and disturbance after some of the eschars are properly placed. Morphin is not often needed, but may be given the first day, if necessary, for pain. The bowels are moved on the fourth day by castor oil. The only dressing is a little vaselin on cotton applied to the external parts.

The catheter, which is so often needed after the ligature operation, is seldom required after the clamp and cautery, and we never hesitate to allow the patient to stand up or sit on a vessel to urinate, if necessary, merely with a caution not to strain the eschars out. This is of great importance in elderly men with enlarged prostate glands, a chronic cystitis being induced by the catheter in a susceptible individual, from which he may never recover. There are many other uses for the actual cautery. The so-called ulceration or granulation of the cervix, the bugbear of every woman who finds it out, may, as a rule, be cured by one or two superficial applications of the cautery. This is the usual treatment in England.

Bottini, of Padua, in 1877 advanced the division of the prostate through the urethra by means of a guarded galvanocautery. This operation has been recently revived with early reports of many successful cases.

The use of the electrocautery in the special surgery of the eye and ear, also the nose and throat, is far too extensive a subject to consider in this paper; I will only say that its application at the present time is on a proved scientific basis, evolved from its free, indiscriminate, and frequently harmful use of a few years ago. Vascular tumors are removed or explored by its aid, and a part of the surgery of the lung and liver tissue is accomplished with the same agent. The section of the uterus in abdominal hysterectomy is made by many operators with some form of cautery.

Few medical men are successful in their profession if they are not enthusiastic. This enthusiasm and ambition sometimes cause them to make early reports of successes following new methods of treatment which time fails to justify. To a great extent this condition followed the much-lauded treatment of joint affections by the use of hot air. The good results depended on a proper diagnosis and application in conjunction with other treatment.

LIMITATIONS OF SURGICAL WORK FOR THE INSANE *

WILLIAM J. MAYO

Modern civilization demands that the surgical diseases of the insane shall be as carefully treated as those of persons of sound mind. The successful invasion of the cavities of the body by the surgeon has stimulated attempts at operative relief for some of the more or less important phenomena which accompany insanity, and it is worth our while to go over the field occasionally and see to what end the efforts have led and to what extent they have been beneficial. For the past eighteen years I have had the privilege of operating upon the inmates of the Rochester (Minnesota) State Hospital for the Insane, and for eight years at the St. Peter (Minnesota) State Hospital for the Insane. The work has been done under the general direction of the superintendents, Dr. A. F. Kilbourne and Dr. H. A. Tomlinson. These hospitals have a total capacity of more than 2200 inmates, and the opportunities for observation have been good.

In the earlier years of my acquaintance with the care of this class of patients the asylum idea was predominant. The primary object was to prevent these unfortunate wards of the State from injuring others, and, if possible, themselves, and this to be done as cheaply as possible. The surgery was that of dire necessity, such as operation for strangulated hernia, the results of traumatism, and malignant disease. Inadequate nursing facilities added to the difficulties to be encountered, and further it must be admitted that surgery was in the transitional period between the "laudable pus" and the antiseptic eras. The results, taken as

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* Read by invitation before the American Medico-Psychological Association at Milwaukee, June 11, 1901. Reprinted from the "Med. Record," August 3, 1901.

a whole, were not encouraging. The advent of the hospital idea, with the trained nurse and skilled care, coming as it did with the enlarging field of modern surgery, gave tremendous impetus toward progress, and the hospitals for the insane today are well managed in this respect. The surgical possibilities have increased in a corresponding ratio, with most gratifying results. This is true as regards the physical infirmities of the insane; but has this improvement manifested itself, surgically speaking, in the cure or marked betterment of the mental condition? Mental instability is aggravated by physical disease and modified by its cure, but insanity itself does not often lie within reach of the surgeon's knife. The layman usually, and the physician too often, seem to think that the 40 to 50 ounces of brain substance would functionate properly if it were not for a reflex impulse having its origin in some physical ailment in another part of the body. If the victim happens to be a woman, the source is promptly traced to the generative organs. From the standpoint of the alienist, the most important factor is the predisposition of the patient, and upon tracing the histories of even those cases in which traumatism seems to have been the one important feature, the number of cases in which hereditary predisposition to unsound mind exists is nearly equal to the average of the so-called "idiopathic" cases. Disease or traumatism may be the immediate exciting cause, but the inherited mental instability is the essential etiologic factor, without which the mental defect would probably not have appeared.

The writer does not possess any special knowledge of the general subject of insanity. The work which has been done has been purely surgical, but it has extended over a period of time long enough to allow the ultimate result on the physical and mental condition of the patient to become apparent. From a scientific point of view, it is absurd to speak of insanity as though it were a malady of fixed proportions, and an opinion drawn from such an indefinite picture of mental disease is of little value. To say that an operation restored to the normal the mentality of an insane person without detailing the exact nature of the brain lesion does not convey much information. We do not expect that relief from a physical ailment will greatly benefit the mental condition of an individual suffering from chronic dementia, although it might aid recovery from acute melancholia. The influence of an operation upon the mental symptoms of an insane individual depends more on the nature of the insanity than upon the surgical procedure which has been performed.

For the purpose of study, the indications for the surgical treatment of the insane may be divided into three general classes. First, the surgical relief of physical ailments without regard to the mental condition; second, operations for the purpose of relieving the mental condition of the patient; third, operations performed with the public welfare in view.

As to the first class, there can be no question regarding the wisdom of giving to the insane the greatest possible relief from the suffering or discomfort of physical infirmity—and this without regard to the mental condition. It is a common experience to see an amelioration of the mental symptoms follow the cure of a hernial protrusion or the removal of a cataract. It can be stated, without fear of successful contradiction, that this improvement does not depend on the location of the disability; I have seen as much relief follow the removal of hemorrhoids as after the repair of lacerations of the cervix and perineum. For the past eight years in both the institutions mentioned an attempt has been made to perform a radical operation for the cure of hernia in patients otherwise in good condition. The necessity for this is obvious. The insane, by reason of their infirmity, are incapable of wearing a mechanical appliance for retention of the protrusion, and strangulations have been frequent and often fatal.

In the past four years some attempt has been made toward the operative relief of prostatic hypertrophies, and a few operations have been performed with fair results. In many wards, especially male, the smell of decomposing urine is present in spite of the best of ventilation. The cause usually lies in the mental condition of the patient, and is covered by the term "filthy habits," but a certain proportion of these unfortunates are the subject of lesions of the urinary apparatus which are amenable to surgical relief. Under the direction of the superintendents a careful physical examination has been instituted among this class of the insane, with a view to bettering their condition when possible. The number of prostatic hypertrophies did not prove as large as expected,—perhaps not greater than among the sane of the same age,—yet the relief afforded has been well worth the effort. I would suggest that urinary disturbance be made a cause of special examination, with a view to ascertaining if there be a physical disability, and that prostatic hypertrophy, calculus, stricture, etc., should be considered surgically. Gall-stone disease is frequent among the inmates, 10 per cent. of the autopsies showing biliary calculi. Not all these patients present marked symptoms, but a considerable percentage suffer greatly, and they should be relieved, other things being equal, by operation. The cases we have operated upon have been most satisfactory. Acute or chronic gastric distress should call attention to the possibility of gall-stones, and repeated examinations made to detect their existence. Diseases of the genital organs in the male, such as phimosis, hydrocele, and occasionally a symptom producing varicocele, may need operative treatment. Diseases peculiar to the female are common: uterine and ovarian tumors, retroversions, accompanied by inflammatory symptoms, lacerations of the cervix and perineum, etc., all demand attention, and, in properly selected cases, should be treated surgically.

A large number of cataracts are to be found among the insane, and they should be removed. These few common indications for operative interference are but examples of the immense field for surgery in which its good results cannot be questioned. The patient has a right to the largest measure of relief which can be given, and our duty is not finished when we have fed and clothed him well; this is important, but not enough. Surgery offers much to the sane, and mental disease should increase, rather than diminish, our efforts in behalf of its victims.

The second group of cases in which operation is undertaken for the relief of the mental condition of the patient has but a limited sphere of usefulness, and the enthusiastic claims of the few are more than counterbalanced by the experience of the many. Traumatic epilepsy and insanity following injury certainly would seem to be the type most fruitful of surgical results. Generally speaking, cure of traumatic epilepsy follows in only 4 per cent. of cases operated upon, and of these, the number in which cure has followed operation when more than two years have elapsed since the beginning of the epilepsy is exceedingly small, and few epileptics are admitted to the hospitals for the insane within two years of the beginning of the epileptic seizures. The predisposition, as manifested in the family history of those who became insane from this cause, is usually too marked to allow much hope of cure, even if treatment is undertaken early.

In a considerable operative experience in traumatic epilepsies and periodic attacks of insanity from the same cause I have seen but two cases in which relief was marked and lasted long enough to deserve attention. In neither case was there a return of the mental vigor, but in both there was amelioration of the periodic outbreaks, and both cases remain sufficiently well to warrant home treatment now for more than three years. These cases were not cured, but benefited.

The hopeless outlook may lead both the alienist and the surgeon to consider operative attack, and in suitable cases it is not only warranted, but commendatory. The lesson to be learned from past experience is that a more careful selection must be made for operative treatment. The surgical cure of insanity, supposed to be due to a reflex irritation in a distant organ, needs but little discussion. The cases are usually reported early, or the mental condition is greatly exaggerated, and the future progress seldom justifies the early prospects. The most energetic work along this line has been done by the gynecologist. In an extensive experience we have seen few, if any, cures brought about in this way, but much relief in suitable cases. The insane woman suffering from disease or injury of the generative organs should be relieved surgically, not because she is insane, but because she has physical disease. The proposition that the diseased condition should be removed because the patient is insane and would not need operation if she were of sound mind is not tenable, and cannot be justified by ultimate result. Asylums of any size for the insane will usually contain a considerable number of women whose ovaries have been removed in the vain hope that cure of the mental disturbance would result, and too often the operation but aggravates the condition. The removal of the clitoris to prevent masturbation, and in this way cure insanity, had its advocates at one time. Fortunately, this distorted view of the nature of mental disease has passed away, and while other misconceptions as to cause and effect have taken its place, the combined experience of the alienist and surgeon renders such delusions short lived.

Operations performed for the public welfare are of questionable propriety, and at the present time would not have legal sanction. In a paper read before the Chicago Medical Society A. J. Ochsner calls attention to the ease with which the vas deferens can be divided without danger to life, and, by the local use of cocain, painlessly. This would absolutely prevent propagation in men, and would not necessarily interfere with the physical use of the generative organs. In a general address before the American Medical Association at the Columbus meeting Daniel Brower advocated the procedure, and he believes the public will eventually demand that some such measure shall be taken to prevent the insane and habitual criminals from continuing their kind. The heredity of psychologic defects is more marked than that of physical deformities, and the position taken by Ochsner and Brower is logical.

An analogous operation in women would hazard life, and as insanity is not a crime, but a misfortune, we would have no moral right to subject them to operation. At my request Drs. Tomlinson and Kilbourne had prepared a short synopsis of 100 surgical cases operated upon, and especial attention has been given to the question of the effect on the mental condition of the patient. The cases were selected at random from a large number of operations, and without any attempt to prove preconceived opinions. The patients chosen had a complete history, with records of the mental and physical condition before operation, during convalescence, and for a sufficient length of time thereafter. The examination includes 60 females and 40 males. Of the females, 16 per cent. were improved mentally more or less by the operation, and of the males, 12 per cent. In most cases the mental improvement was such as we would naturally expect from the physical relief afforded. The patient looked brighter and appeared more cheerful, and, in a few cases, the restoration was sufficient to enable the patient's return to home life. Only one patient was discharged cured in this series. This was a case of acute depression in a man admitted to the St. Peter State Hospital suffering from chronic appendicitis. The process became suppurative, and the mental and physical improvement after operation was coincident. As an equal number of patients was chosen from each of two hospitals situated at some distance apart and as the proportion of mental improvement was nearly the same in each, a comparative table has considerable value.

The physical improvement was marked in nearly all the cases operated upon. The results, however, do not justify the statements which have occasionally been made as to the influence of bodily disorders, especially those of the female generative organs, in the production of insanity. Surgery has done much for the physical comfort of the majority, benefited the mental condition of a few, but rarely has materially contributed to a perfect restoration, both mental and physical.

In conclusion let me say that the insane, from a surgical standpoint, have the same right as the sane—no more, no less.

PREËXISTING HEART DISEASE IN REFERENCE TO SURGICAL OPERATIONS*

WILLIAM J. MAYO

The demands of modern civilization tax the energies of the individual to the utmost. A sound heart in a sound body acquires a new significance under these conditions, for the burden of effort falls, to a large extent, upon the circulation. Clinical observers of wide experience believe that diseases of the heart are on the increase, not the mechanical lesions which we so long considered the chief source of cardiac disability, but failure of the heart muscle through disease.

Therefore, we have measured the heart power by the size of the obstacle to be overcome, but in reality more depends upon the perfection of the cardiac contraction and its ability to overcome resistance. The normal heart has a vast reserve power. The sound muscle-fiber quickly recuperates from overwork, and the circulation fails but momentarily. This is not true of the compensating heart. Hypertrophy is a conservative process. It does not begin at the exact moment the circulation is obstructed, but at a time when at least a portion of the reserve has been expended. Compensation in itself presupposes a lessened reserve force. The more exactly the compensation balances the obstruction, the less the liability of cardiac failure under temporary effort. To the surgeon the condition of the cardiac muscle is of prime importance. A crippled heart may compensate for the ordinary affairs of life, but the question is, has it sufficient reserve force to carry on its function during an operation, which, though temporary in character, is attended by an increased call upon the heart's strength?

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* Reprinted from the "Amer. Jour. Med. Sci.," August, 1901.

The dangers to be feared are very real, and do not lie entirely in the anesthetic. The necessary injury to the nerves and other tissues of the body, with the loss of blood, must be taken into account, and the amount of this operative traumatism cannot always be foretold with certainty.

The circulation demands that the arteries be kept overfull; the heart must be equal to keeping the pressure in the arteries greater than in the veins, and premonitory symptoms of a failing compensation must be earnestly sought before an operation is undertaken in the face of cardiac disease. The reserve power of the normal heart is not so great in infancy and old age, although the writer has not found this to be as true of the latter as of the former period of life. Very fleshy people have less reserve force, and from an operative standpoint are generally looked upon with suspicion. People of unusual height are also supposed to have relatively less cardiac reserve. We have had considerable experience in the Northwest with people above the average height, and have found them, as a rule, most excellent subjects for operation.

The enervation of the heart plays an important part in estimating an operative risk. It must, at least, be sufficient to enable the reserve force to be called into play. His demonstrated that the power of contraction lies in the muscle-fiber of the heart itself, and that it exists before the cardiac plexus is formed. The vagus and sympathetic are integral factors in the cardiac ganglia, and disturbance of function, resulting in excessive rapidity or slowness of the cardiac pulsations, may often be traced to reflex conditions acting through the nerve-supply, or it may be a personal or family idiosyncrasy. An irregular or intermittent pulse may also result from the abuse of tea, coffee, or tobacco. The cause in any event should be determined, and the probable influence upon the patient's ability to withstand an operation estimated.

Heart lesions may properly be divided into two general classes: First, valvular and endocardial disease; second, myocardial changes. The sharp distinctions between them have, however, passed away with the advent of better knowledge of the subject.

Myocardial changes are often found associated with valvular disease, particularly so when compensation begins to fail, while in the later stages of myocarditis secondary valvular lesions are common.

Between the ages of ten and forty valvular disease is usually well compensated, and if the heart's action is easy and the circulation well carried out, the operative risk is not great. In our experience we have never lost a patient from this cause. There is but little liability of overlooking the condition; the early development of characteristic murmurs and the ease with which the hypertrophy can be recognized enable the surgeon to gage the disability with a fair degree of accuracy. The operation is undertaken with full knowledge of the cardiac disability and its character, and the choice of an anesthetic is greatly influenced by this condition. If there is failing compensation and signs of marked dilatation, only operations of the greatest urgency should be undertaken without preparatory treatment. It is fortunate that valvular lesions are most common during the active period of life, at which time the large majority of operations become necessary. After forty, valvular lesions are usually associated with some degree of myocarditis.

I do not wish to be understood as minimizing the importance of primary valvular lesions, but rather to point out that the ease of diagnosis and the fair degree of accuracy with which the compensation can be estimated do not render it a frequent cause of operative mortality. The knowledge of the cardiac insufficiency robs it of much of its danger.

Myocarditis is the condition which the surgeon has reason to fear. There are often no sign-posts of danger, and the first intimation of trouble is the sudden death of the patient upon the operating table or shortly after leaving it. It may happen that the operation was performed for the relief of some condition which in itself was not serious, and which would not have been undertaken if knowledge of the heart disability had been previously obtained.

That a heart which is not increased in quantity, as estimated by the usual means of diagnosis, and the quality of its action seemingly unimpaired, should suddenly fail when called upon for a temporary reserve force, is an appalling fact, but nevertheless true. Fortunately, the large majority of cases do give signs and symptoms which, if looked for with care, will enable the surgeon to detect the possibility of disease, and in the later stages the diagnosis may be self-evident. Cardiac symptoms after middle life not plainly pointing to valvular lesions are probably myocardial in origin. Preble quotes the following on myocardial disease from Huchard: "Their evolution is latent, their beginnings insidious, their course paroxysmal, their progress interrupted. They are complicated by a variety of visceral manifestations, and are brutally sudden in their explosions of cardiac insufficiency."

Acute myocarditis results from various infections, and may date its origin to an attack of diphtheria, gonorrhea, quinsy, influenza, or other infectious disease. If death occurs primarily, there may be no macroscopic evidence of disease of the heart; the changes are microscopic (Stengel). Acute myocarditis usually passes into the chronic form, but the large majority of cases of chronic myocarditis are so from their inception. The disease is marked by the development of fibrous tissue and other nutritive changes brought about through lesions of the coronary arteries. Rosenbach believes the fibrosis to be a conservative process, and that it braces up a feeble muscular power. Freer, on the contrary, maintains that it is primarily a destructive one, and analogous to fibrosis of the kidney.

Fatty degeneration of the heart, according to Strümpell, von Leyden, and others, seldom gives signs of its presence except in the later stages.

In experimental fatty degeneration produced by Hasenfeld and Fenyvessy, there was no change in the cardiac size, nor was the rhythm or force of the pulse affected. Stokes considered pseudo-apoplexy, soft blowing systolic murmurs with a slow pulse, pathognomonic of fatty degeneration, but as myocarditis was but little understood in his day, it was only the cases in which this condition was more marked than the fibroid changes which were recognized. Fatty degeneration is often an accompaniment of myocarditis or of one of its results, and the great loss of reserve force which it produces, together with the difficulty of even an approximate diagnosis, makes it the most serious complication of the heart from a surgical standpoint.

Lesions of the aortic opening and valves appearing about middle life can also be classed with myocarditis, and are often associated with it. Changes in the coronary vessels and at the base of the aorta usually coexist. This form of valvular disease has what may be called a physiologic basis, and is more serious than similar lesions at the aortic opening in the young. Beneke, by a series of measurements, has shown that after forty years the aortic opening gradually increases in size, and it is easy to understand how severe work or disease might lead to grave consequences. Myocardial changes associated with arteriosclerosis and contracted kidney must also be taken into account.

The writer does not wish to discuss the symptomatology or pathology of myocarditis, but merely to call attention to the diminished reserve force of the heart which it entails, and point out that many of the unexpected and sudden deaths which take place at or soon after an operation are due to this cause. A patient in middle or later life showing signs of progressive cardiac weakness, manifested by a vigorous heart contraction with a feeble pulse, irregular in rhythm, and associated with cardiac pain and attacks of dyspnea, with general loss of strength, is to be looked upon with suspicion, and an operation is not to be undertaken lightly. The more advanced cases of myocardial disease present such characteristic symptoms that only life-saving procedures would be indicated. The two following cases, illustrating the operative mortality, are briefly reported:

Case I.—*Cholecystotomy in Patient with Chronic Myocarditis; Sudden Death Forty-eight Hours After Operation.*—Mrs. J. D., aged thirty-five years, American. First came under observation in September, 1900, with a history of gall-stone disease. On examination the heart's action was found to be 120, pulse feeble and intermittent; a faint mitral murmur could be detected. There was slight increase in size. Patient complained of attacks of dyspnea and oppression in the chest, and at times slight vertigo. No direct history as to the origin of the cardiac lesion. The attacks of colic were frequent and very distressing. Patient pale and anemic. In the face of grave myocardial disease operation was not advised at this time. On January 5, 1901, she was readmitted to St. Mary's Hospital; the heart's action was very much improved, pulse 112, fairly good quality. Patient's physical condition better, but the attacks of gall-stone colic were frequent, and some jaundice had followed the last attack. On January 8th cholecystotomy was performed. The operation was easy and quick. There were no complications. Anesthesia, nitrous oxid and ether. Time, twenty minutes. Patient was in excellent condition for forty-eight hours, when she suddenly died from cardiac failure without premonitory symptoms.

Case II.—*Abdominal Hysterectomy for Malignant Disease in Patient with Chronic Myocarditis; Death on Operating Table from Chloroform Anesthesia.*—Mrs. E. E., aged forty-eight years, German. Admitted to St. Mary's Hospital on January 10, 1901. This patient came under observation four years ago with an ovarian tumor, and at that time had physical evidences of myocarditis. The tumor was removed under ether anesthesia. She had remained in fair health except for occasional attacks of dyspnea, palpitation, and a chronic cough. She returned for the relief of malignant disease of the body of the uterus. On the day following admission the patient developed influenza and bronchial pneumonia, and over two weeks elapsed before she was in a condition for operation. The heart's action was forcible, the pulse full, intermittent, and 120 to the minute. There was marked hypertrophy and a mitral murmur, with evidence of chronic myocarditis. On January 26th abdominal hysterectomy was undertaken under chloroform anesthesia. This anesthetic was chosen on account of the bronchitis, which had been much aggravated by recent illness. The patient took the anesthetic badly, and was given but little. The operation had proceeded about ten minutes, when the heart's action and respiration suddenly stopped and the patient could not be resuscitated.

Heart lesions secondary to the disease for which the operation is undertaken may be either valvular or myocardial—usually the latter. The most common are due to obstructed circulation by the pressure of large tumors, especially uterine myofibromata. Hofmeier collected 18 cases in which sudden death occurred from this cause. Williams, of Bristol, in 8 fatal cases unoperated states that 2 died from heart disease. Péan met with 4 severe cases in 24.

There is at first compensatory hypertrophy, later secondary dilatation and degeneration of the heart-muscle, usually associated with valvular disease. Sibileau, in 17 cases of this character, notes that the lesions are usually mitral. The dangers to be apprehended occur not only at the time of operation, but later from embolus. We have met with 5 of these cases, all of them associated with large myomata, and in which no history of cardiac disease preceded the development of the tumor. In 2 the lesions previous to operation were exceptionally severe, and it seemed questionable whether an operation was justifiable. The convalescence of our patients after hysterectomy was uninterrupted, and I was able to examine 3 of the cases as to the cardiac condition after the lapse of a year or more. The improvement was most marked, the size of the heart greatly diminished, and the valvular lesions could be detected only by the most careful examination.

Without going into the moot question as to the nature of exophthalmic goiter, it may be stated that at least some cases result in myocarditis or fatty degeneration of the heart, and perhaps this has been one of the causes of sudden death which follow thyroidectomy. In 7 thyroidectomies for Graves' disease we had 1 death from this cause. The history of the case is briefly as follows:

CASE III.—*Thyroidectomy for Exophthalmic Goiter in Patient with Myocardial Disease; Operation Performed with Local Anesthetic; Death in Twenty-four Hours from Cardiac Asthenia.*—Miss K. S., aged twenty-seven years, American; occupation, housework. Admitted to St. Mary's Hospital in May, 1899, with a history of exophthalmic goiter which had appeared a year previously. The severity of the symptoms was gradually increasing. The immediate cause of admission was an ovarian cystoma the size of a fourth-month pregnancy. During the period of observation the pulse was constantly above 130; no direct evidence of cardiac lesion. The tumor was removed under chloroform anesthesia. Recovery uninterrupted, and she was discharged in three weeks. Readmitted

August 29, 1900. The phenomena attending Graves' disease had markedly increased; pulse weak, and constantly above 140, and on exertion 160 or more. There was a faint murmur to be detected at the apex of the heart, evidently mitral in origin. The heart was somewhat enlarged and forcible in action. Attacks of dyspnea were frequent, and the patient very anemic and emaciated. On September 1st the right lobe and isthmus of the thyroid gland were removed under local anesthesia with cocain. The operation was not attended by any untoward accidents. The pulse became exceedingly rapid after the operation, and a mild delirium supervened. Twenty-four hours later the patient died from cardiac asthenia.

It will be noted that in the 3 fatal cases reported 1 died suddenly forty-eight hours after an easy operation apparently well borne. The second died from the anesthetic on the operating-table, and the third twenty-four hours after an operation under local anesthesia.

In going over the records of the cases operated upon in St. Mary's Hospital it was found that over 1 per cent. had had some form of heart lesion existing before the operation.

PRINCIPLES IN DRAINAGE *

CHARLES H. MAYO

The subject of drainage is one of the utmost importance, and is involved in every wound, injury, and inflammation. Most operative conditions are of such a nature that external drainage is either not considered, or is so positively indicated that its use is not a question, but a fixed fact—a part of the operation. Even these latter cases try the judgment of the occasional operator in answering the question, How long and by what means shall drainage be instituted? A few operators have treated the subject to some extent in the description of special operations, but more often it is described by the term "drainage was employed" or "not employed," as the case might be, when in reality it was the sole purpose of the operation.

A large percentage of surgical work involves diseases which must necessarily be drained, and it would seem that some principles could be established to govern the major portion of operations; to indicate which cases require drainage and how long to maintain the same. The nature of the secretion or purpose of the drain should indicate its character.

The causes of inflammation are from thermal, mechanical, or toxic irritation, the last including the chemical changes caused by bacteria. From one or more of these agents acting through the local nerve-supply there occurs a dilatation of the local arteries, veins, and capillaries, followed by an increased rapidity of the circulation, which soon slows, and the white cells adhere to the endothelial layer and pass between these cells, to become the leu-

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* Read before the Sioux Valley Medical Association at Ft. Dodge, Ia., June 25, 1903. Reprinted from "The Medical Herald," St. Joseph, Mo., September 1903.

kocytes in the surrounding tissue. More severe irritation, and the plasma exudes; still more severe, and there is a free escape of blood-cells and fibrin, and the exudate is now capable of coagulation. Exudates are known from their quality as serous, fibrinous, croupous, diphtheric, hemorrhagic, or suppurative. Serous exudates follow irritation, and also occur in passive congestion and venous stasis; as represented by forms of eczema, anasarca of advanced cardiac or renal disease, and the ascites of obstructed portal circulation. The exuded fluids may become inoculated with bacteria in open wounds, or bacteria may make an exudate from the irritating power of the toxins and the peptonizing power of the bacteria. This fluid is known as pus, and consists of the plasma with white corpuscles and the fixed tissue-cells converted into pus-cells, with the bacteria peculiar to the infection. Without going into tedious and well-known details, we may state generally that, of the more common types of infection, inflammation caused by the staphylococcus develops a wall around itself; the streptococcus develops no protection of any importance, and the tubercle bacillus develops the inflammation behind its progress. Some authors would limit the term inflammation to the infected cases only, calling the changes incident to other forms of irritation reparative processes.

In fresh wounds there is an escape of a bloody, serous, albuminous fluid from the divided tissues, lymph-spaces, and capillaries. This fluid distends the tissues and separates the injured surfaces, preventing or delaying healing, and, being highly albuminous, is subject to infection and decomposition. It is to relieve the tissues of these fluids that external drainage is established. The result of considering drainage as being the delivery in all cases of exudates to the surface is the probable explanation of why each operator has developed a system from his own experience with reference to this subject.

The fact that the greater part of absorption of the body is accomplished by the lymphatics is well understood, but seldom thought of in relation to surgical work. Solutions such as salines are not only absorbed by the lymph-system, but also pass into vessels by osmosis. The absorbents in the main accompany the vessels, and practically are found in all portions of the body, although very deficient in some regions and organs. All exudate or waste material, then, must first be absorbed before it can be excreted, or must remain as a local collection where certain varieties may aid in repair. When not absorbed or held locally, it must be delivered externally. This thought, carried further, indicates the peculiarity of the diseases to which certain organs are subject, and explains the symptoms developed in the course of disease of septic nature. The brain, for instance, while filled with lymph-spaces, is very deficient in lymphatics, the subarachnoid space serving as the absorbing area on its surface. In its substance we often have a hemorrhagic exudate remain as a local collection; then, by means of secondary changes from crenation of the blood-cells and a deposit of fibrin and albumin, a surrounding wall is developed and the exudate is now a cyst, the change requiring from a few weeks to months. Injuries of the skull and brain develop cystoid scars as a result of adhesion of the membranes and shutting off of the arachnoid space. Inflammatory diseases, unless involving the surface, will cause a subnormal, normal, or slight rise in temperature. It is well known that small abscesses may remain many years in the white substance of the brain without symptoms.

Similar changes, yet less positive, occur in the kidney, which is also deficient in structural lymphatics. These cystic changes are of frequent occurrence. Abscesses are local and do not cause functional disturbances unless the capsule is perforated and the lymph-system of the cellular space invaded; the symptoms developed arise from a change in the kidney function, its own deficient absorbents not being enough to carry toxins in any quantity to the circulation. The liver is deficient in absorbents, and abscesses in its substance may show but little acute general disturbance, as marked by fever and reaction, shown in the chronic abscesses in this region, unless there is a venous communication.

The lungs are rich in lymphatics, and infections or toxins are early and constantly delivered into the circulation, with the resulting reaction of fever. The onset of infections in regions rich in absorbents, as the lung, neck, axilla, or groin, is often marked by a chill, to be followed by continued temperature during the infection until reaction develops protective granulation. Repeated chills occur in regions in which accumulated pus is delivered at intervals into the venous circulation without the intervention of the lymph-system, as in sinuses of the brain, liver, bone-marrow, uterus, or prostate, and occur in streptococcus poisoning where the edema and induration may cause veins to open as sinuses, or when local foci of infection occur in the circulatory system itself.

The fundus of all organs is deficient in lymphatics, hence acute obstruction gives cyst formation and chronic inflammation causes shrinking and thickening of the organ. The body has a certain degree of resistance in the blood against infection. Fresh blood is germicidal to some extent; later it is also a culture-medium, from the contained albumin. It is increasingly germicidal at a temperature of from 100° to as high as 104° F., rapidly losing it thereafter with increasing heat. The plasma, free from albumin, is more strongly germicidal than the blood. There is a continuous absorption of all exudates in regions supplied with lymphatics: in infectious diseases carrying to the circulation toxins and at times bacteria, and as a result of increased tissue metabolism, there is a temperature. From repeated infections the system may become nearly or quite immune to reactionary disturbances, and local infections long retained lose their virulence from a type of continuous inoculation by absorption in minute doses, and from the death or loss of virulence of the bacteria.

Varieties of Drains and Drainage Adjuncts

First: Rest by splints, pressure dressing, or bed, to quiet the circulation. Second: Elevation, to reduce arterial supply and favor venous and lymphatic return. Third: Massage, to break up coagulated exudates and enable the lymph-vessels to remove the exuded material. A good masseur, for instance, will relieve the ecchymosis and swelling of a black eye in a remarkably short time by alternate massage and rest. Fourth: Moist dressings favor escape of exudate from open wounds, and also favor the lymphatic circulation in closed injuries. Fifth: Adjuncts to drainage in the use of solutions having affinity for moisture acting by osmosis, as glycerin or alcohol. Sixth: Wound drainage is accomplished by the open method, with or without secondary suture. Seventh: Separate incision. Eighth: Wicks, capillary or tubular drains, or gauze packs, as mechanical aids.

Capillary drains are of catgut, hair, or silkworm-gut in bundles, and serve to drain serum of small amounts in small wounds or in large wounds, where prolonged aseptic drainage is required, as after gland removal. Capillary drainage is not sufficiently free for the drainage of pus. Tubular drains deliver freely all wound secretions, and in aseptic cases should serve their purpose in from twenty-four to forty-eight hours. When of rubber, they should be split from end to end instead of perforated. By means of a thread attached to the tube the drain may be removed at this time without removal of the dressing. In septic cases the tubular drain should be left until the wound is lined with granulation tissue and is without pockets or accessory cavities, as granulation tissue is the natural protection of the system against absorption, as well as being a reparative process. Freely to drain the peritoneum nothing seems better than glass, as lymph adhesions form slowly about its surface; thus a large area is brought under its influence. Gauze is peculiar in its action at first, being a capillary drain; later its meshes become choked with fibrin, and it no longer has a capillarity; therefore it should not tightly fill the opening from which it emerges. It is a great developer of granulation, as it strains out the blood-cells and fibrin from the serum, thus holding in apposition to the cut tissues elements necessary to the development of granulation. Tube drains carry away the same material and granulation will be slower. It is this peculiar action of gauze which makes it necessary to leave it without disturbance for at least six days. Previous meddling will tear open the young granulations, give fresh injury, open lymph-spaces, and in septic cases it is usually a cause of temperature. Gauze is used in draining acute injury of the brain and in the quarantining of acute infections of the peritoneum. Aseptic operations are frequently followed by from 1 to 3 degrees rise in temperature within from twenty-four to thirty-six hours, which is caused by absorption of blood and is a ferment fever. Temporary fever later than this may be from the intestines, but if this temperature continues, the wound should be examined, as it is probable that there is some disturbance in the healing process.

We may say, then, that aseptic operations in regions rich in lymphatics, where the lymph circulation is but little disturbed, will not require drainage—as ligation of vessels in the neck, Alexander's operation, and hernias in the inguinal region. Aseptic operations in these regions in which the lymph-system is removed require capillary drainage from four to six days, as auto-drainage is temporarily abolished and early removal results in serous accumulations without temperature, discovered usually when the cases should be dismissed from care, as in removal of cervical glands, cancer of the breast and axillary glands, and malignant disease of testicle and inguinal glands. Free drainage of the stump should be employed in amputation for malignant disease where the glands are removed from the axillary or inguinal region.

In regions rich in lymphatics, where operations for septic conditions must necessarily be made, we open fresh areas for absorption of toxins, and we should endeavor to use upon the incised surface strong antiseptics, such as carbolic acid, followed by alcohol, chlorid of lime as a caustic, or in mild cases glycerin, to prevent or inhibit the action of the absorbents, and maintain the disease as a local infection. This is markedly shown in operations for the removal of bone necrosis. For the same reason the cautery is used to excise abscesses in certain regions, and also to make puncture drains of cellular streptococcus poisoning.

Iridectomy and scleropuncture in glaucoma substitute one set of lymphatics for another. In operations for the relief of increasing spina bifida a suture of two strands of silkworm-gut or catgut can be passed through the stump of the sac, temporarily to deliver the spinal fluid into the tissues of the back. Experimental work is now being conducted with a view to permanently draining forms of hydrocephalus into the rich lymph-system of the cervical region. In the drainage of wounds it is a good rule to make a separate incision at the most favorable point and close the original operative wound completely. This plan will improve the scar, and in abdominal incisions will very often avoid hernia.

Pleural cavity drainage is best instituted by an incision in the posterior axillary line at about the sixth or seventh interspace. In most cases it is best to remove a section of one or more ribs. A curved forceps is passed into the chest and pushed out of the cavity between the ribs, in the anterior axillary space, two or three ribs higher. The skin is incised at this point, and a perforated rubber drainage-tube drawn through the chest; a pin is placed in each end. This drain is easy to hold in position, does not irritate the expanding lung, is of known length, is never lost, and can remain indefinitely.

Bladder drainage was for many years perineal. During the past twenty years it has been by suprapubic incision. The recent advance in our knowledge of the prostate and its diseases has again returned bladder drainage to the perineal type, except in special cases of stone operations. Suprapubic drainage may be aided by some form of siphon apparatus, or if the bladder-wall is folded upon the drain by suture, every purpose is fulfiled.

The peritoneum is but little less in area than that of the entire skin covering of the body. Its lymphatic system is most active in the upper portion of the abdomen. The lymph-vessels of the peritoneum over the small intestine are numerous, while there are few in that portion covering the large intestine, which is capable of but little absorption, as is the parietal or pelvic layer. The peritoneum covering the colon is, then, exudative, and over the small intestine absorptive, not considering the lacteals of the mucous membrane.

In aseptic operations of the abdomen involving considerable bruising or denuding of the peritoneum the pelvis should be elevated by raising the foot of the bed, the gravity acting as an aid to auto-drainage, the peritoneum being capable of absorbing from 3 to 8 per cent. of the body weight in an hour.

In septic diseases just the opposite condition is desired to secure drainage and maintain the condition as a local one, by elevating the head of the bed and also elevating the upper extremity of the patient to gravitate to the pelvis, where delivery may be made through glass tubes. This method is used in diffuse peritonitis. The diseased or septic focus should also be quarantined by a gauze pack through a separate incision, should the condition of the patient warrant the increased operative interference.

MORTALITY, DISABILITY, AND PERMANENCY OF CURE IN SURGERY*

CHARLES H. MAYO

By means of the selection of cases, aseptic care, and the kindness of nature an average surgeon may have a low death-rate and yet benefit his patients but little. The question of mortality is one of the most important in surgery, and yet there is no rule concerning its method of computation. A study of mortality should be based on some definite plan to render reports and statistics of value to others than those who make them.

Hospital reports seldom present to the reader more than a general estimate of the amount of work done by the individual operator. They may, to some extent, add to the respect paid to his opinion by those able to judge. However computed, the mortality-rate serves its purpose, as far as the surgeon is concerned, in giving an approximate rate, which is liable to a certain amount of fluctuation, due frequently to uncontrollable circumstances. We once performed a consecutive series of 179 abdominal operations of all kinds without a death; in the one hundred and fifty-sixth case the patient operated on died, yet such a statement, unqualified, would be of no value to other surgeons, as there were 5 deaths in the next 20 cases.

Some operators claim that if the patient dies from the operation it should be counted, but if he survives the operation for a time, although failing to get relief, and dies from the disease or complications, the death should not be charged to the surgical work. This method allows a large latitude for the surgeon unconsciously to favor or discredit some particular operation, according to his prejudice. A well-known surgeon believes that if an individual dies within fourteen days after an operation from any cause, the death should be attributed to the operation, but after that time it is a question to be settled by the judgment of the operator.

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* President's address before the Western Surgical and Gynecological Association at Milwaukee, Wis., 1904. Reprinted from "Northwestern Lancet," May 15, 1905.

In our work at St. Mary's Hospital we have taken the view of the layman, that if the patient goes into the hospital alive and comes out dead, the death resulted from, or in spite of, the operation, charging as a death from operation every patient who dies in the institution without regard to cause of death or the time elapsing between the operation and the fatal issue, some patients dying as long as three months after from disease or accidental cause, such as apoplexy, pneumonia, nephritis, heart disease, pulmonary embolism, etc.

The greatest reduction in mortality has come through aseptic and antiseptic methods, which have been reduced to such simple principles that they are within reach of all. This has been the means of developing skilled surgeons, who still further reduced the death-rate by an intelligent selection of cases, reduction of operative shock, and careful post-operative care. There is unquestionably a proper time for surgical intervention, and the failure to grasp the opportunity at the favorable moment is the cause of the greater part of the mortality, besides increasing the period of disability and reducing the number of cures. With the growing intelligence of the profession there is much less delay, owing to their advice, than formerly; in fact, there are at present few physicians watching tumors of the breast to see if they are malignant before advising removal. This is also true of cancer in other regions, and today cancer is classed among curable diseases when operated on early, while still local, and without metastases. We might also say that only cancers of the stomach are still retained in the medical wards until starvation, stasis, and the failure of nutrient enemata demand surgical intervention at the most unfavorable moment.

The surgeon has not been blameless in inducing the public to delay operations: not directly, but indirectly, by operating on the hopeless cases of cancer in which the inoperable condition could be proved, and in which incomplete operation is followed by more rapid growth. The continued disability and the inevitable death become necessarily associated in the minds of laymen with the operation, deterring others from seeking early surgical relief, and inducing them to look for some religious, irregular medical, or quack method of cure.

Statistics

In appendicitis the contrast between the mortality in cases operated on at a favorable period and the reverse (including the operations of necessity) has taught even the layman not to trust too much or too often to the kindness of nature. The mortality, therefore, has been reduced to a very low point.

During the past year 516 cases of appendicitis were operated on in St. Mary's Hospital. Of these, there were 147 acute cases, with 4 deaths; a number of these patients had diffuse peritonitis requiring general abdominal drainage. There were 362 chronic or interval operations and 10 tuberculous cases, with no deaths. This does not include 244 appendectomies made incidental to other abdominal operations, as where more than one procedure is accomplished through a single incision only the major is counted. Five years ago such results could not have been obtained, as we did not have the coöperation of the public. During this same year there were 106 gastro-enterostomies, with 8 deaths (7½ per cent.), most of these deaths being due to advanced cancer, while in 13 pylorectomies and partial gastrectomies there were no deaths, owing to the early stage in which the disease was attacked. Abdominal hysterectomies gave a death-rate of 5 per cent. in 101 cases, an increase of 2 per cent. over former years, due to a greater effort to eradicate malignant disease, immediate results being subordinated to permanent.

In no class of work did the low mortality of early operation contrast more favorably with the unavoidable death-rate, due to delayed surgery, than in gall-stone disease. In a recent review of the mortality of 1000 operations up to December 1, 1904, for gall-stone disease, we showed an average death-rate of 5 per cent. in the hospital, 960 for benign disease, with a mortality of 4.2 per cent. The total list does not include 101 cholecystostomies and 44 cholecystectomies in connection with common-duct operations. There were 673 cases of cholecystostomies, with a mortality of 2.4 per cent. This group includes most of the acute infections. Cholecystectomy was done 186 times, with a mortality of 4.3 per cent. This operation was employed for special indications, such as cystic duct operation, thick-walled gall-bladders, suspicion of malignancy, and cholecystitis without stones. There were 137 operations for stone in the common duct, with a mortality of 11 per cent.—7 per cent. from operation and 4 per cent. from secondary complications after more than three weeks. Those patients operated on during the quiescent period with little jaundice and slight infection recovered; 4 patients with extreme icterus and with subcutaneous hemorrhages died; 4 patients with complete obstruction of the common and hepatic ducts which were filled with clear fluid and no bile died. There were 40 cases of malignant disease, with a mortality of 22.5 per cent. In contrasting these mortalities we must constantly remind ourselves that in simple uncomplicated gall-stone disease the death-rate in 416 cases was less than 0.5 per cent., and that practically all the complicated cases were at one time in this stage when a safe operation could have been done. Of the cases of malignant disease, practically all showed that gall-stones had played the part of a chronic irritant.

Operations in the upper abdomen, involving the stomach, liver, and pancreas, give a higher mortality than those of the lower abdomen, as it is near the danger zone of active absorption, and adhesions are more permanent from lessened peristalsis.

The cases of shock we have seen following operations have been due to loss of blood, to handling the small bowel, and to traction on abdominal viscera and large nerves.

Laboratory substitutes for blood were rarely employed, as, while temporary improvement was noted, the operation necessary involved its own risks and disadvantages. The almost unknown chemistry of the living cell secures the best preparation of solutions to fit them to mix with the blood; and to cause the least harm, therefore, when deemed necessary, as in starvation and shock, we use the subcutaneous infusion or the slow rectal salt enema, without pressure, after Murphy's method.

Disability

We have materially reduced the time of detention of patients as compared with the same operations in the developing days of surgery. Going back only six or eight years, we have reduced this time to such an extent that it represents a gain equal to the board, care, nursing, and disability of one person for approximately over thirty years. For instance, in hernias, in the early days these patients were in bed four weeks, and even six years ago three weeks. This is now reduced to thirteen days in favorable cases. Stomach and gall-bladder cases are confined to bed from twelve to fourteen days; formerly this time was from eighteen to twenty-five days. In 169 gastric operations with recovery this year a saving was made of about two hundred weeks. To almost the same extent a saving of time has been obtained in all classes of operation. During the year it was most marked in cases of appendicitis. Formerly these operations in non-drainage cases detained patients three weeks; now the patients are up in eight days and home in ten, a saving during the year of about fourteen years. In considering the subject we must not be intimidated by those who retain their patients an excessive length of time, nor be rendered reckless by those who, at the other extreme, urge the mobility of abdominal cases the next day after operation.

The operative incision should rarely be employed for the drainage of abdominal sepsis. One or more separate punctures ought to be made for this purpose at the most favorable situation, and the original incision closed, thereby avoiding hernia liability and shortening convalescence.

In our practice every effort is made to secure dry wounds. Temporary drainage is employed in incisions through fat structures where the lymph absorbents are often unequal to the task of drainage. Other operations which do not remove lymph-nodes are not drained unless infected. All operations in which glands are removed are drained. Irrigation is not employed in septic cavities for the removal of fluids derived from the tissues of the body, such as empyema. Irrigation is at times employed for the removal of foreign materials, such as escape from perforation of the stomach or intestine. Severe peritoneal sepsis, such as occurs from a ruptured appendix, if diffuse, is treated by the exaggerated Fowler position (sitting posture), with large drains in the pelvis. The results are remarkably good in this class of cases, which was formerly so fatal.

Permanency of Cure

The bugbear of surgery is malignancy; the bulk of mortality, recurrence, and disfigurement is from cancer. A poor surgeon, so far as operative skill or dexterity is concerned, may be a great surgeon from the standpoint of radical cure. The only way that regular medicine can defeat methods and schools of quackery is to study them, and to prove by results that there are better methods. Efforts at legislation merely advertise such irregular methods, too often to our disadvantage, by placing those who practise them in the light of being persecuted. The principal progress made in the study of cancer has been recognition of its mode of extension and of the cause of death. Until this was manifest in many instances we could claim but little over the man with the cancer paste except shortened convalescence.

Investigation into that much-neglected portion of anatomy, the lymphatic system, has finally placed the surgery of cancer on a scientific footing. Possibly little reduction has been made in primary mortality, but a great improvement in permanent results has been effected.

In considering the general subject of cancer, it has been our experience that age, as a rule, makes a great difference in the rapidity of the progress of the disease, as well as in the prospect of cure, cancer in the young being early disseminated by the activity of the lymph-system, while in the old, with atrophic lymphatics, the disease may remain essentially inactive and local. Other conditions being the same, each additional decade of life gives improved permanent results. Early operation, with the removal of the glands through which the drainage is effected, gives a high percentage of cures. Today the first thought of the surgeon who makes a diagnosis of cancer is in regard to the adjacent lymphatics. Few cancers destroy life in their original location except mechanically; it is principally the secondaries which kill. The great danger, then, is through the lymphatic system, in which secondary growths develop and through which the blood-stream is invaded. If cancer does not ordinarily cause death in its primary situation, the thorough removal of the lymph-glands draining the area is of as much importance as removal of the disease itself.

In the alimentary tract the colon is one of the more favorable locations for removal of cancer without recurrence, as the lymphatics of the colon are much less active than those of the small bowel. Fortunately, malignant disease occurs in the proportion of about 17 in the colon to 1 in the small intestine. Approximately, about one-half of the deaths from colonic cancer occur from obstruction and perforation before the glands are involved.

A radical change has taken place in the methods of attacking cancers of the rectum, an abdominal incision being first made, and, if the case is inoperable from a curative standpoint, by reason of the extension of the original growth or secondaries, a colostomy is performed if there be obstruction. In the curable cases a combined operation is performed from above and below, with removal of all the perirectal tissue, fat, glands, and fascia with the rectum.

The primary mortality in cancer of the breast need hardly be considered. Of course, there will be unexpected deaths from pneumonia, apoplexy, pulmonary embolism, or some other unavoidable complication. To the removal of the gland areas belongs the credit for excellent results now obtained. The muscle removal is merely incidental to the thorough operation on the absorbents.

It is difficult to estimate the primary operative mortality of brain injury, as in most cases the operation is partly associated with the injury. Such operations, made early, are remarkably successful, both in low mortality and in freedom from secondary symptoms (epilepsy, etc.).

The brain, from its functions and anatomic structure, has but limited ability for repair, therefore what is to be accomplished should be accomplished early, before secondary morbid conditions are established. Operations for chronic conditions of the cerebrum are removed from pessimism only by the low mortality and wonderful results in occasional cases.

SURGICAL OPPORTUNITY *

CHARLES H. MAYO

We hear much of preventive medicine and very little of preventive surgery. Once an impression prevailed that surgery was the handmaiden of medicine, to be invoked only in dire necessity. This was in the preantiseptic and preanesthetic days. We now know that a number of so-called medical diseases are purely mechanical in their effects, and are, at all periods, surgical and easily cured by surgical measures.

The final results of disease as shown at autopsy were so often looked upon as having been a part of the original condition that they were used as a further proof of the justifiability of not operating earlier.

How many physicians even today congratulate themselves upon curing gall-stone disease, or attack after attack of appendicitis in the same patient!

A physician is as culpable in allowing patients to drift into an inoperable condition without exploration as he would be to let them drink water from a probably infected well. In order to lower the mortality and increase permanency of cure it is more important to grasp surgical opportunities than it is essential to understand principles of preventive medicine. It is often easier to generalize and draw conclusions from a small experience than from a large one.

The term *inflammation* is bad, used as it is indiscriminately, applied to nature's best efforts at defense and repair, as well as the results of infectious processes.

A few years ago the laboratory and laboratory methods became so popular that the patient was almost forgotten in the examination of secretions, excretions, and blood. Clinical examinations were made light of, and the old practitioners could with difficulty locate themselves or their work. The necessary association of all methods has gradually led to the selection of the essential and useful. For example, in blood examination the leukocyte count, which some years ago was looked upon as of great value to the surgeon in septic processes, gradually fell into disrepute as unreliable, but more recent investigation shows that it is of great value if a differential count is also made indicating the relative proportion of polynuclear cells as compared to the total leukocytosis. A relatively high count of polynuclear cells indicates low resistance, even if a high leukocytosis, indicating intense reaction, is present. A comparatively low count of these cells stands for a high state of resistance. When we can properly employ cytology and acquire the ability to control the opsonic property of the blood, we shall make the next great advance in surgery and medicine.

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* Reprinted from the "Northwestern Lancet," August 15, 1906, pp. 339–341.

The conditions following most injuries and many infections can be divided into separate stages—usually three—which are well marked.

(1) In a fracture the immediate damage to the bone and the consequent effusion into the soft tissues following the injury. During the succeeding seven to nine days there must be an absorption of exuded and coagulated material before the system can exert more direct efforts at bone repair. The operative treatment of fractures should be very early—the first day, before continued effusion infiltrates and distends the soft tissues, or after nine days, when repair requires mere apposition of fragments. The open treatment of fractures which cannot be adjusted, or in which there is any doubt, is a method of treatment growing in favor. The opportunity in bone infection is to relieve tension and limit destruction by drilling or perforating the marrow early. The time of election to aid nature further is to remove a sequestrum after such delay as is necessary for the formation of an involucrum of sufficient strength to support the bone.

(2) In the infection of appendicitis there is necessarily an obstruction of the lumen of the appendix between the area of infection and the cecum. Repeated attacks may not pass the first stage. In progressive cases the acute inflammatory condition may be retained about forty-eight hours—sometimes more, often less. Then the rupture and second stage follow, in which the symptoms change from essentially local to more or less general. Modified by the type of infection or degree of resistance, we have local or diffuse peritonitis. The dangerous period of this stage extends over about four days more.

(3) The third stage is that in which nature has absorbed the pus after sterilization, or still retains it as a local accumulation, to be delivered by an operation or by rupture.

Practically all surgeons are agreed as to the advisability of operation in the first and third stages, but the mid-interval following rupture in desperate cases is still debatable ground; yet the bad cases—the operative hernias, intestinal fistulas, and deaths—have necessarily passed by that safe early period of operative interference. This, to be sure, is because patients do not always seek relief in time. But the public is rapidly becoming educated, and the responsibility of delay must be placed upon some one.

In the question of injury to the skull and brain we must consider what we know concerning the brain's reparative ability, or, rather, lack of it, from the permanency of its functions and the limited ability to absorb within its structure. The remote effects must be considered, as well as the failure to cure so large a proportion of those operated upon at a late period for relief of the effects of such injury as shown by degenerative conditions and epilepsy. Therefore, the efforts at repair and prevention of epilepsy should not be delayed until a little improvement prevents this being recommended or accepted, but should be made at a period early enough to be associated with the injury. Again, if the conditions are such as to render operation justifiable, and an exploration of one side of the brain is made without satisfaction, the other side should, by all means, be examined.

While we cannot look for much repair of brain or spinal cord tissue, we can expect great repair and regeneration of all nerve tissue which has a neurilemma, as has been pointed out by Murphy. Sensory nerves have a wonderful power of regeneration; motor nerves require a favorable opportunity.

How often, in cases of glaucoma, is surgical opportunity lost through waiting for supposed cataracts to ripen, when a simple iridectomy might have prevented blindness? In this field also the danger of sympathetic loss of sight is certainly not made sufficiently important in our medical colleges, or there would not be so many such cases following efforts at saving blind and useless eyes.

In diseases of the ear the simple operation of paracentesis of the tympanic membrane has probably saved deafness, much disability, and not a few lives. If the mastoids were opened on suspicion, instead of after a careful watching and weighing of symptoms, an incalculable amount of good would be done. To make a diagnosis of mastoid disease after weeks or months of discharge and after a large external abscess has been formed is as uninteresting as it would be to make a diagnosis of gall-stone after colic and jaundice appeared.

In considering the great scourge of the human race, tuberculosis, we must not neglect to mention the preventive surgery of the throat, *e. g.*, removing disordered tonsils and adenoid hypertrophy. Incidentally, it might be said that this simple operation will relieve an untold amount of ear disease as well.

Tuberculosis gaining entrance through the tonsil may pass to the first tonsillar gland, and, by a direct or tortuous route, infect a few or all the cervical glands, and gain entrance into the venous circulation, to be generally distributed. Most of the deaths occurring from tuberculosis are due to the results of mixed infection, except when located in the brain. There is a favorable time for operating upon tuberculosis, and that is after the acute stage is past and the disease can be recognized as a local one.

Surgery of the upper abdomen, involving the stomach, liver, and pancreas, gives a higher mortality than that of the lower abdomen, as it is near the danger zone of absorption, and adhesions are more permanent from lessened peristalsis.

Surgery of the stomach, as it is practised today, is reducing years of sickness incident to chronic ulcer and obstruction, preventing cancer, or, at least, is finding it early enough to be curable. The mortality of such work can no longer be urged as a further incentive to delay, as modern statistics show partial gastrectomy in suitable cases to be quite as favorable as in cases of cancer of the breast. As soon as laymen understand that cancer of the stomach is nearly as favorable as cancer externally located, it will be as difficult to hold them under medical treatment as repeatedly to treat and temporarily cure relapsing appendicitis.

A review recently made by W. J. Mayo of 1500 operations upon the gall-tract demonstrates the failures to grasp the favorable moment, when all diseases, including many acute and chronic infections, are confined to the gall-bladder. The mortality in this group of cases and two cases of pulmonary embolism was 1.4 per cent. The cases which required cholecystectomy showed a mortality of 1.62 per cent., while in the common duct cases with liver duct and pancreatic complications the mortality was about 12 per cent. We must bear in mind that the mild and safe stage for operation comes at some early period to nearly all who suffer with the disease. Another consideration is that about 4 per cent. of such cases present primary cancer of the ducts of the liver, with its apparent origin about an impacted stone—a further protest against delay.

In pelvic disease the woman with the large fibroid uterus should have explained to her the present as well as future possibilities in growth and degeneration or change in structure, since no one is more vitally interested than the patients themselves.

In cases of pus-tubes the patient is often not seen in the early stages. In the second stage of local diffuse peritonitis, like that in certain types of appendicitis, it is often considered advisable to aid nature in her efforts to resist and sterilize or, at least, develop an immunity to the infection. The immunity is often such that a moderate amount of leakage from the sac of retention will not call for drainage or create even severe symptoms.

There is certainly a proper time for operating upon cancer, and that time is unquestionably early, while the growth is still confined to the original structure of origin or the lymph-nodes of drainage. Cancer treatment has passed through many peculiar phases, a large number of which are due to the medical profession through imperfect, delayed, and often ill-advised treatment, with the result that innumerable cancer cures and methods of treatment were employed in the profession and out of it.

About one-half of the cancers which occur in the human race affect the alimentary tract. The *paste quack* could not work here, yet in external cancer, up to twenty-five or thirty years ago, he did nearly as good work as was done by the medical profession. Cancer of the breast has been almost removed from the field of quackery because even the laity have learned about the glands of the axilla and the dangers from this source. Cancer of the lip will also be removed from the hands of the quack as soon as better work is generally done in this region by the surgeon, and when the surgeon explains that cancer of the lip, like cancer of the breast, does not destroy locally, but destroys by extending through the lymph-system, death being essentially due to secondary metastatic growth.

In considering cancer of the rectum we find the disease in a removable structure which is slow to disseminate infection, and yet approximately only one-half of the cases are discovered at the operable period, as far as curability is concerned, the condition usually being diagnosed as external or internal piles. This error is due to the lack of marked symptoms in the early period, to the carelessness of the patient, and often to the failure of the physician to examine, although he prescribes. Scientific progress and a better knowledge of the changes in the body incident to disease and repair have greatly reduced the field for drugs, even at a time when some of our best known therapeutics, under the guise of original articles, for revenue only, are adding to our enormous list of remedies.

New methods of stimulating nature to develop favorable cell changes are growing in favor. Medicine and surgery, not through effort, but by reason of natural laws, are becoming more closely associated. The coming man is not the surgeon, nor the internist, but the diagnostician.

TRAVELOGUE

THE ADVANTAGES FOR POSTGRADUATE WORK IN BOSTON*

WILLIAM J. MAYO

I had the pleasure of visiting Boston early in the winter, and was agreeably surprised to find the advantages for postgraduate instruction to be so great. I feel that I am safe in saying that no city in this country can offer greater attraction to students in special work, and I am confident that the men in the Northwest have not fully realized that Boston ranks with New York, Philadelphia, and Baltimore as a great medical center. The amount and character of the surgical work in the Massachusetts General and the Boston City Hospitals are equal to those of any hospitals with which I am acquainted, and I have no doubt that as much can be said of the other hospitals and special departments.

One meets a very cordial welcome from the medical men, and the number in attendance at the daily clinics is not too large to give the very best opportunities for observation. In each hospital there are three surgical divisions, and the material is so abundant that not infrequently all three operating-rooms are in simultaneous use. The whole of New England is drawn upon for material, and the supply of the rare and curious cases in this clinic is particularly interesting to the student.

The greater part of the day may be properly spent in either hospital. The concentration of material saves time for the visitor, which is so often wasted in going about from hospital to hospital. Another important feature is the high grade of all the work. If the chief of the staff is not present, one has small reason to regret it, since the next in line takes his place, and he is abundantly able to do so. Surgery in Boston is a fine art, and it is essentially the same no matter who the operator may be. To my mind Boston is the home of what might be called American surgery, in this respect differing from the West, where surgeons not infrequently abandon old and tried methods which have given good results for the new method of some continental surgeon. Boston surgeons have confidence in their own judgment and in their own way of doing things. If a certain procedure gives good results, it is continued until something else is proved better.

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* Reprinted from the "St. Paul Medical Journal," May, 1899, p. 389.

From a westerner's standpoint, the work does not begin early enough in the morning, and the clinics are not started with the promptness which is customary with us.

I found that the Harvard Medical School men located in Minnesota were kindly remembered and often referred to. All seemed interested in Wheaton's work, and manifested a sincere regard for Foster, who was for two years house surgeon at the Massachusetts General. The visitor to the clinics is received with an unfailing courtesy which is characteristic of Boston. I am glad of this opportunity to express my appreciation of such courtesy, as well as of the excellent work which is being done there.

A VISIT TO THE SURGICAL CLINICS OF NEW ORLEANS *

WILLIAM J. MAYO

The Medical Department of Tulane University is the center of medical activities, and as an institution of learning it is in the front rank of the medical colleges in America. Its Anatomic and Pathologic Museums in particular are perfect mines of information.

The profession of the city maintains a medical library, which is also the home of the New Orleans Parish Medical Society. A large office building is occupied entirely by physicians, much after the fashion of the western cities.

The largest hospital in New Orleans is the Charity Hospital, which was begun in 1848. It is under the charge of a sisterhood of the Catholic Church, and now contains 800 beds. This hospital has one of the finest clinical amphitheaters in this country, and, in addition, two modern private operating-rooms of lesser size. The care of the female patients is in the hands of trained nurses, and is excellent in every respect, which cannot be said of the care given the male patients. The white and black races are about equally divided. Separate wards are maintained for each. Having lived always in the region above the negro belt, I was naturally much interested in observing the variations of pathologic manifestations in the colored race, as can be seen in the Charity Hospital.

Rudolph Matas, Professor of Surgery of Tulane University, is the chief surgeon to the Charity Hospital, and we had the pleasure of witnessing his surgical clinics almost daily during our visit. Matas is a master of technic and a speaker of unusual impressiveness. These clinics were, therefore, most interesting and profit-

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* Reprinted from the "St. Paul Med. Jour.," March, 1900, pp. 208–9.

able. Matas is an ardent advocate of the use of cocain as a local anesthetic, and has been active in developing the method of anesthesia by cocainization of the nerve-supply. In one case he cocainized the overlying skin, cut down upon and cocainized the sciatic nerve, and then the internal saphenous nerve. After this he amputated painlessly at the middle of the leg. The case was one of gangrene of the foot in an old colored man with advanced cardiac disease.

Edmund Souchon, well known for his contributions to the study of aneurysms, is also one of the staff at the Charity Hospital. He gives a very interesting clinic. At the time of our visit he was much occupied with State Board of Health work, preparing for a possible outbreak of yellow fever with the advent of warm weather.

F. W. Parham also gives a surgical clinic at the Charity. He is a surgeon of marked ability, a rapid and bold operator, and has made contributions of great value to the surgery of the thorax and thoracic cavity. In conjunction with Matas, Parham has developed a modification of the Fell-O'Dwyer apparatus for the purpose of artificially inflating the lung and preventing pulmonary collapse on opening the pleural cavity. This procedure has been used successfully at the Charity Hospital in keeping up respiration in cases of opium poisoning.

G. S. Lewis holds a gynecologic clinic, and F. R. Sexton a genito-urinary clinic. The material in both departments is most abundant, and is handled to the best advantage.

We are under obligations to Dr. Felix A. Larue, Assistant Superintendent of the Charity Hospital, for many courtesies, also to Dr. Herman B. Gessner, the assistant surgeon.

Other hospitals of note are the hospital "Hôtel Dieu," of about 100 beds, in charge of a Catholic order, and the Touro Infirmary, under Jewish auspices, with about the same capacity.

The visitor to the surgical clinics is most cordially welcomed. At no time did we find the traditional southern courtesy lacking. I would recommend New Orleans, with its many attractions, as a most desirable place for a physician to spend a winter vacation.

NOTES ON A VISIT TO THE SURGICAL CLINICS OF GERMANY AND FRANCE *

WILLIAM J. MAYO

To the American traveling in Germany for the purpose of visiting surgical clinics some of the smaller cities offer superior advantages. The large clinics of Berlin and Vienna are well known, and so largely attended that personal observation is difficult, and one is debarred from that close contact with the operator and the observation of operating-room and patients which are of such great value.

Langenbeck was the first truly great German surgeon: he was the Gross of his time. Langenbeck brought from Paris, then the surgical center, to Berlin new methods and ideas which revolutionized German surgery. Billroth became Langenbeck's disciple, and when he was called to Vienna, these two cities, Berlin and Vienna, at once rivaled and eventually eclipsed Paris in the surgical world.

Contemporaneous with Billroth another great surgeon appeared in Germany: Volkmann, of Halle, also a former assistant of Langenbeck's. Volkmann applied his knowledge and skill especially to surgical tuberculosis and diseases of the osseous system. He may be said to have originated modern surgery of the bones and joints.

Billroth and Volkmann were not only great surgeons, but they were inspiring teachers, shown by the fact that so many of their assistants are in active work, having hospitals in the smaller German provinces which rival in character and extent hospitals in the great centers of Berlin and Vienna, and, because of the smaller

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* Reprinted from the "St. Paul Medical Journal," October, 1900.

number of observers, present the advantage of being able to get into close touch with the work.

Czerny, once first assistant to Billroth, is at Heidelberg, and Schede, a former assistant of Volkmann, is in Bonn. Mikulicz, Wölfler, and many others were assistants to these two men—in fact, more than half the chairs of surgery in German universities are filled by former assistants of Billroth and Volkmann.

Kocher, of Berne, is the commanding figure in German surgery today. He spent three years in London as Lister's assistant, and in all respects is a product of the best German, French, and English thought.

Germany has many fine hospitals. At one time the Empire was a collection of free cities and petty kingdoms, and the conditions were then favorable to the establishment of hospitals as State institutions. In united Germany this condition of things has been encouraged in the same substantial manner.

HAMBURG

Hamburg is a beautiful city. With its suburbs and the adjoining town of Altona, it has a population of about three-quarters of a million people.

The Hamburg Hospital was built about twelve years ago, and occupies a large area of land two miles from the center of the city. The institution comprises about 100 buildings, and its total capacity is in the neighborhood of 2000 beds. At the right of the grounds are the buildings for men; to the left, for women. The pavilion system of construction has been used exclusively. Each building is one story in height, containing a large ward and a few private rooms at one end. The operating theater, which is two stories in height, is also entirely separate, and contains three operating-rooms. This plan of construction necessitates carrying each patient on a covered cart out-of-doors and down the avenues to the ward after operation. The second floor of the operating theater is devoted to the library, pathologic museums, etc. A separate building devoted to massage apparatus, baths, etc., is one of the finest institutions of its kind in existence. Another very complete building contains the anatomic and pathologic department. The bacteriologic, microscopic, and postmortem work is also done in this building, and the whole is under the charge of Fränkel, one of the greatest pathologists in Europe.

The surgical material in this hospital is enormous, and it was utilized to good advantage by Schede during the fifteen years he was chief. Five years ago, after Trendelenburg went to Leipsic, Schede was called to the University of Bonn, and his place was filled jointly by Kümmell and Sick, the latter having been associated with Schede in the hospital work for a number of years. We spent two weeks visiting this hospital—in the operating-room each day from 10 A. M. to 1 P. M. or later, and in the wards at various times. Kümmell was away on his vacation, and Sick was in charge as surgeon-in-chief. He is a dextrous operator, has no fads, and gives one the impression of being a judicious and conservative surgeon. The material was most abundant and diverse in character. All classes of operations were done equally well.

An operation for hydrocele was very neatly performed. The sac was dissected out to its testicular attachments, and opened, then turned backward around the testicle, sutured in this position, and dropped back into the scrotum, the tunica vaginalis being turned wrong side out. For gastro-intestinal anastomosis Sick uses the suture. Kümmell prefers the button, and for gastro-enterostomy utilizes a button modified by his assistant, Hildebrandt, in which the intestinal portion of the button is made larger, to prevent its dropping back into the stomach. Weir, of New York, has made a somewhat similar modification of the button.

In tuberculous joints and abscesses iodoform emulsion, 10 per cent. in glycerin, is still in use, after an experience of years. The cases selected for this treatment are unmixed infections, and particularly where there is fluid which can be removed and replaced with the solution. Unsuitable cases are treated by operation. Tuberculous glands of the neck are extirpated by careful dissection, in which the spinal accessory to the trapezius muscle is carefully preserved. The *x*-ray is used for lupus, with fine results. Röntgen-ray facilities are quite perfect in this hospital.

At the Altona Hospital we were most cordially entertained by Krause, best known in America in connection with Hartley, of New York, as one of the originators of the Hartley-Krause osteoplastic resection of the skull for the removal of the Gasserian ganglion. He has performed this operation 23 times, with 2 deaths. Krause is a very active man, forty-three years of age, and has recently been called to Berlin as surgeon-in-chief of the Augusta Hospital. He was Volkmann's first assistant for seven years in the clinic at Halle. After Volkmann's death he came to the Altona Hospital. Like all Volkmann's assistants, Krause is a fine surgeon. We witnessed a number of his operations on bones and joints, which were most instructive. He uses iodoform emulsion in tuberculous joints and after partial resections for tuberculous foci. Instead of suturing tightly at once, he packs with iodoform gauze for four days; he then removes the gauze, fills the cavity with iodoform emulsion, and sutures without drainage.

Lauenstein, familiar to American surgeons by his contributions to surgery of the intestines, etc., is at the Seaman's Hospital. He is a large man, about fifty years of age, and a fine surgeon. The material for observation was good, and since there were no students and we were practically the only visitors, we had an excellent opportunity to observe the work.

I did not see any of the Hamburg surgeons using operating gloves of any description.

BRAUNSCHWIEG

Braunschwieg, about four hours' ride by train from Hamburg, is a city of 150,000 inhabitants. It is an old city, containing many ancient buildings of considerable historic interest. The province of Braunschwieg has about 2,000,000 people.

The State Hospital here has nearly 500 beds. The general plan of the buildings is not unlike the Hamburg Hospital, with spacious grounds laid out in streets. The buildings are detached, but, unlike its model, each building is three-storied, with connecting wings and corridors, giving each department the advantage of a separate building. The department devoted to massage is particularly fine. The surgical department is under the charge of Sprengel, a former assistant of Volkmann's. Sprengel is about forty-seven years of age. He is a most excellent surgeon. There are two operating-rooms side by side; in one the aseptic, in the other the septic, work is done. He operates four mornings and overlooks the dressings the other three mornings of the week. During our visit to his clinic he operated every day from 10 to 2, and dressed patients before and after operating, thus giving us a splendid opportunity to observe his methods and his work. As would be expected in an assistant of Volkmann's, his bone and joint work is especially fine. He usually wore rubber gloves in his clean cases, and used silk for sutures and ligatures. He does not like catgut. For gastro-intestinal anastomosis he uses the Murphy button, except in the large bowel, where he prefers the needle and thread. He has experienced the disaster of having the hole in the button plug with solid feces, and the accumulated gases tear the adhesions loose. In local tuberculosis, joints, and other tuberculous foci, he uses a powder of equal parts of calomel and iodoform.

Sprengel has paid a great deal of attention to hip-joint abscess cavities, for which he uses iodoform emulsion. He has developed a method of exposure which is very complete. An incision to the bone is started below the great trochanter, extending upward between the margin of the gluteus medius and the tensor vaginæ femoris, to a point just beneath the anterior-superior spine of the ilium, then in an easy curve backward along the iliac crest; the whole of the enormous flap of skin, muscles, and periosteum is turned backward, exposing the joint and acetabulum, rendering it easily accessible to operation, either for disease of the head of the femur and acetabulum or osteomyelitis of the ilium. The bleeding is very slight and there is no after-contraction or tendency to displacement.

Another case of great interest was one in which he removed the whole of the sternum, the costal cartilages, part of seven ribs on one side and five on the other side, for tuberculosis. A large goiter was removed through a long incision from the angle of the jaw to the upper end of the sternum; complete separation of the sternocleidomastoid muscle, internal jugular vein, and transverse division of the thyrohyoid muscles was made. After this exposure the thyroid gland was lifted out, exposing the superior and inferior thyroid vessels and the recurrent laryngeal nerve in a manner I have never seen equaled even on the cadaver.

The pathologic department of this hospital was under Dr. Bencke, a fine pathologist. He has recently accepted a call to a Japanese university.

I was already familiar with Sprengel's contributions to surgical literature, and very glad of an opportunity to visit his clinic. I can testify to the excellent management of a very large amount of material.

Bonn

Bonn is one of the oldest university towns of Germany, and is most aristocratic, Emperor William having graduated from its university. The city contains about 40,000 people, but the University Hospital is supported by two provinces of 7,000,000 people. The hospital grounds are spacious, and most of the buildings modern. Each department has a separate building of two or three stories, consisting of private rooms, wards, etc., connected by corridors.

Schede is the surgeon-in-chief of this hospital. He is a small man, about fifty-five years of age, of quiet voice and few words. As an operator he is quick and sure, and while watching him one has a feeling of absolute confidence in his knowledge and judgment. Schede arrives at the hospital at 8.15 A. M.; he walks the wards, overlooks the work, and at 9.30 A. M. he meets his class in the amphitheater, giving a clinical course for an hour, followed by two and one-half hours of operating. Schede has two chief assistants, von Graff and Peterson, who came with him from Hamburg. Schede uses the needle and thread in gastro-intestinal work in preference to the Murphy button. He does not use rubber gloves. Ariol, a silver salt, is used as a powder in all clean as well as septic wounds, and most cases are drained with iodoform gauze. In tuberculous bones and joints iodoform emulsion is used in the unmixed infections; we observed a number of cases treated in this manner. I was particularly interested in two Kraske operations for rectal cancer which he performed. An osteoplastic flap of considerable size was made of the coccyx and lower sacrum. After checking the hemorrhage with needle and catgut, the rectum was loosened just above the internal sphincter and cut across, making a provisional suture of the proximal end. The peritoneum was then opened, and the sigmoid, which was drawn down, loosened freely, and the peritoneum resutured to the bowel higher up. The mucous membrane of the lower fragment was removed with the anal skin, the gut cut across above the growth, and the inner end drawn into the muscular funnel below and sutured to the skin. Should there be any tension on the gut, a heavy silver-wire mattress suture is introduced each side from the sacral end of the incision into the skin laterally on a line with the anus, and the whole anal region retracted upward. The execution of the various steps was particularly fine. The dressing was held in place by a cotton trunk, that is, drawers coming only to the upper part of the thigh. The operation is practically the one used in America. Among other interesting operations was an excision of a thyroid gland through a curved incision. After exposure the desired part was simply excised, and the bleeding points caught with forceps and tied with catgut on a needle. A tuberculous ankle was excised by Lauenstein's method, beginning the incision on the fibula above the external malleolus, and passing from the tip of this process forward and downward in an easy curve to the fifth tendon of the extensor communis digitorum. By reflecting the entire flap inward and separating the lower boundary of the incision from the bone, the ankle was dislocated outward, and the tuberculous foci, which in this case included the astragalus, was radically dealt with.

We observed many interesting and instructive things in this clinic, and, as elsewhere in Germany, were treated with great courtesy.

COLOGNE

Cologne is a city of 350,000 inhabitants, and the center of the mining and manufacturing industries of Germany. The numerous railroads and shipping on the Rhine all add to the hazard of life and fill the accident department of the large hospital with a great amount of material.

The Cologne Hospital is situated in the heart of the city, and is very old, although it is being gradually modernized. Six hundred beds are devoted to the surgical service. Bardenheuer is the chief surgeon. He is a small, elderly man, but very active in his movements. He is an authority on fractures and dislocations, having at his disposal the largest number of this class of patients of any hospital in Germany. He advocates extension in all cases of fracture by means of weights and pulleys, applied in a manner to counteract muscular contraction. As shown by *x*-ray, the anatomic results are remarkably good. He claims that there are less callus and speedier recovery under his method of treatment than can be shown by any other, and has recently brought out statistics on 8000 cases to sustain his position. We witnessed an operation upon a case of ankylosis of the knee with partial luxation of the head of the tibia backward on the femur. He made lateral incisions, divided the hamstrings, and separated the popliteal contents from the posterior capsule of the joint. With a knife he then partially divided the posterior capsule and reduced the dislocation and malposition. For tuberculous joints he uses iodoform emulsion, and he advocates extirpation of tuberculous cervical glands. After excisions of tuberculous foci he sprays the cut surfaces with iodoform and ether. We also witnessed an excision of an elbow-joint for tuberculous disease. He left the ulna longer than the radius, and nailed it to the end of the humerus, intending to leave it in this position for three weeks before beginning passive motion. In this way a flail-joint is avoided, and union is seldom sufficient to interfere with motion.

Gloves are not used in this clinic.

Paris and the International Congress

The International Medical Congress was attended by about 6500 members, and as many of the members were accompanied by their families, the total number was not far from 10,000. Of these, 450 were from the United States, and about the same number were from the British Empire and from Russia. Germany had a somewhat larger representation. The great bulk of the Congress was made up from the Latin countries, with a considerable number from Mexico and South America. The official languages in the Congress were English, French, and German. The Section on Surgery was well attended. Interesting papers were read by Murphy, Weir, Keen, Ochsner, and others from the United States, and as these papers will appear in American journals, comment on them here will be unnecessary.

Among the papers from the British Isles, two were of particular importance: one by Mayo Robson, on "Surgery of the Pancreas," with especial reference to chronic pancreatitis. Robson has seen some 18 cases, most of which were mistaken for malignant disease. Seventeen recoveries have followed drainage through the gall-bladder. Maylard, of Glasgow, made a very important contribution to the diagnosis of intragastric disease. For example, after an abdominal incision is made the stomach is opened and siphoned out, and the interior inspected through an old-fashioned Ferguson vaginal speculum with direct light. There were a number of papers from Germany: one by Krause, "Removal of the Gasserian Ganglion," reporting 23 cases observed personally. In his remarks Krause said that in all the cases in which the Gasserian ganglion had been completely removed the neuralgia had not returned. There was a paper by von Eiselsberg, "Surgery of the Stomach," in which he reported 150 cases of various sorts. Von Eiselsberg prefers the suture for gastro-enterostomy. He illustrated his technic by excellent drawings.

We attended the afternoon sessions of the Section on Surgery, and it was very interesting to see the great surgeons of the world and to hear them speak. We spent the forenoons in visiting the hospital clinics, and were fortunate enough to see a number of the best surgeons to good advantage. I was much pleased with Tuffier's work, and visited his clinic several times. Tuffier is a medium-sized man, about forty-five years of age. He wears a dark beard, and has a most expressive face; his personality is charming. He works rapidly and quietly, with a few simple instruments, one assistant, and a nurse or two. I liked him for the things he did not do, as well as for the many things he did do. In one instance he operated on a patient, a boy with a pistol-shot of the thigh. The *x*-ray showed the bullet at the knee, near the outer condyle. He made an incision, and after a careful hunt of a few minutes closed the wound without finding the bullet, saying that further endeavor would result in more harm than the bullet. On another occasion, in doing a nephrectomy for tuberculous disease, he split the true fibrous capsule of the greatly enlarged kidney and removed it from within its shell, using forceps on the pedicle and leaving them attached. With an audience of famous surgeons from America and all parts of Europe, the temptation would naturally be to do the more brilliant operations, but the steps he followed were sounder surgery and serve to illustrate his conscientious regard for his patients. In all operations below the diaphragm spinal anesthesia is used. This method has been in use for some time, but I had never before witnessed its practical application. The patient walks in and gets upon the table, bends forward, and the lumbar region is rendered aseptic; a long needle is then passed between the lumbar vertebræ on a line with the posterior-superior spine of the ilium, from a point three-quarters of an inch to the right of the midline. It is introduced slowly until a few drops of cerebrospinal fluid run out, after which the cocain solution is injected. In five or ten minutes the analgesia is complete. The patient talks, can move, but feels no pain. We were present while a hysterectomy, an amputation, and several other capital operations were performed under this anesthesia. The anesthesia lasts from one to one and one-half hours. The patients have an appearance of pallor, with a hectic flush; some of them are nauseated. The pulse is feeble and the temperature is high, but this disappears within twenty-four hours. Tuffier has never seen any permanent bad results; nevertheless I shall not adopt the procedure until long experience has proved its advantages. The central nervous system does not regenerate after division, and I should fear future complications.

Tuffier operates at the Hospital Lariboisiere, made famous by his predecessor, Péan. Tuffier was the only surgeon in Paris whom I saw using gloves.

Doyen is a man of great private fortune, and has built for himself in Paris a fine hospital of about 50 beds, costing 1,000,000 francs. The hospital is run regardless of expense. He has several photographers, pathologists, and the best of everything that money can buy or hire. Doyen is nearly six feet in height, with light hair and beard, and is about forty-five years of age. He is very ingenious, and has invented an operating-table and a great number of instruments. As an operator, he is exceedingly dextrous, and operates with great speed, setting at defiance nearly all the generally accepted principles of surgery. We saw him do a craniectomy for epilepsy on a case which had been operated before. He applied an Esmarch band tightly about the head just above the ears, and with an electric saw and drill of his own invention proceeded to turn down a large osteoplastic flap of horseshoe form; after making a crucial incision in the dura, he replaced the flap and sutured with a continuous suture of silk. The operation took about fifteen minutes. He then brought in a similar case, upon whom he had operated in the same way five days before. A large clot of blood was producing pressure under the flap; under anesthesia he reopened and scraped the clot out. Between operations he took us to another room, and with a cinematograph showed himself doing a number of operations with great speed—a most interesting exhibition. We then returned to the operating-room, and he did an operation for cancer of the breast; the amputation was made with great rapidity in the old-fashioned way. A small incision was made in the center of the axilla; some fat and glands were pulled out of the small opening and tied off. The operation had been completed, and two of the visitors, not Americans, began to handle the instruments, when Doyen turned on them and spoke very sharply. His French was too rapid for us to follow, but from the looks of their faces I judge that his remarks were not complimentary, and perhaps reflected on their intelligence. As he had just been describing the instruments, I could not see that the rebuke was entirely necessary.

Lucus Championnière is a small man, about sixty-five years of age, wearing a full gray beard. He is best known in America by his contributions to the subject of fractures, which he treats by massage and without fixation, and for his work on the radical cure of hernia. He operates at the hospital "Hôtel Dieu," the oldest hospital in Paris. It stands upon the island in the Seine, upon which the original city of Paris was built. Hôtel Dieu was rebuilt about fifty years ago, at an expense of 47,000,000 francs (nearly $10,000,000). We had the pleasure of seeing Championnière do two hernia operations, using the flap method. The cord is not lifted, and after the sac is separated and tied off, the external oblique is doubled upon itself, making two thicknesses over the canal, very similar to a method I have used for several years in closing umbilical hernia. He has performed this operation nearly 800 times. Championnière sponges out his wounds with 5 per cent. carbolic solution and uses drains.

Pozzi operates at the old Hospital Brocca, which is limited to diseases of women and skin diseases. Pozzi's great work on gynecology has made him familiar to American readers. At the clinic we attended a number of celebrated gynecologists and surgeons from various parts of the world were present. One of the cases operated was a hysterectomy for inflammatory disease. The operation was difficult, and several inches of bowel were injured and removed. The accidental injury to the bowel might have disconcerted a less resolute operator, especially in the presence of distinguished visitors. Pozzi, however, calmly completed the operation with the patient in good condition.

ADDRESSES

OBSERVATIONS ON CANADIAN SURGERY *

WILLIAM J. MAYO

In the month of September, 1901, in company with A. J. Ochsner, of Chicago, I had the pleasure of visiting Montreal and Toronto, and we found much in these cities of interest and profit.

MONTREAL

Montreal is a most interesting city. It has a population of not quite half a million. The people are essentially French in character and sympathy, and their position is not in full accord with the aims and ambitions of the Anglo-Saxon population. After the war of the Revolution and the birth of the United States, in order to prevent Canada from either uniting with the States or separating from the British Empire, a charter was enacted which recognized the French officially in the public schools, public offices, courts, etc., and allowed an existence of French institutions on a plane with English, thus dividing the country so thoroughly that agreement in matters of common interest is difficult and uncertain even now, and, after a hundred years of contact, few signs of an assimilation are to be seen. The dividing lines are closely drawn, and this is particularly true of the hospitals.

The Royal Victoria Hospital has 230 beds, and was built in the last decade. The surgical service has about 75 beds, and is under the charge of Dr. James Bell, chief surgeon, Dr. A. E. Garrow being the assistant surgeon. We had the pleasure of seeing Dr. Bell operate on a patient with gall-stones, and do an exploratory operation on a case of intestinal tumor which, after a careful examination, he decided was beyond surgical intervention. He gives the anesthetic in the Trendelenburg position in every case, and

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* Reprinted from "Northwestern Lancet," November 15, 1901.

believes that it prevents bronchial irritation by allowing the mucus to gravitate outward. As an operator, he is careful and considerate of the tissues. He does not use rubber gloves. In the wards he showed us many rare and interesting cases. The hospital has a number of separate wings, and occupies one of the finest sites in the city. There is a gynecologic service with about 20 beds. Dr. J. G. Adami is the pathologist to this hospital.

The Montreal General Hospital has about 220 beds, and has existed eighty years. Being in the heart of the city, it is not so beautifully situated as the Royal Victoria. It has four surgeons each, with a six months' service, two at a time. They are G. E. Armstrong, F. J. Shepherd, J. A. Hutchinson, and J. M. Elder.

Dr. Armstrong was on duty during our visit, and we spent an interesting day with him. He is a most careful and thorough operator and an interesting speaker. In doing a radical operation for an inguinal hernia, he expressed a preference for catgut sutures. He incises the conjoined tendon to secure greater mobility of the tissues below the internal ring. In an old case of osteomyelitis following fracture he removed with a chisel one entire side of the bony cavity, allowing periosteum and soft parts to drop in, and after most painstaking antisepsis with carbolic acid and alcohol, sutured without drainage.

In the wards Dr. Armstrong showed us several cases of recovery after operation for typhoid perforation, and said that, out of a considerable number of operations, they had eight recoveries in that one hospital. He also exhibited a case of recovery after general septic peritonitis following appendicitis, in which, with local anesthesia with cocain, he had drained, and kept the patient under the influence of opium in moderate doses. He said that opium after operation for septic peritonitis seemed to save some patients, and mentioned the old opium treatment. We also saw a case in which the internal carotid had been successfully tied for cerebral hemorrhage of non-traumatic origin (apoplexy).

Dr. Shepherd, who alternates with Dr. Armstrong at the Montreal General Hospital, shares with Dr. Armstrong and Dr. Bell a well-earned reputation for surgery in the Canadian provinces.

They are all connected with the Medical Department of McGill College. Dr. Shepherd's frequent contributions on surgical subjects to United States' medical periodicals make him, perhaps, the best known with us. He is quick in his movements, and talks earnestly and to the point. He is said to be an excellent operator, but as he was out of the city until about the time we were leaving we did not have an opportunity to see his work.

The Royal Victoria Hospital and the Montreal General Hospitals are connected with the McGill University. They are both modern hospitals, up to date in every respect, and are under English influence.

The Hôtel Dieu is the largest and oldest hospital in the city, having been founded over two hundred and fifty years ago. It contains 300 beds. The building is fairly well adapted to caring for patients, but the public wards are much too large (44 beds), and there is no separation between the medical and surgical cases. There are four attending surgeons: Sir William Hingston, the chief, is seventy-one years of age, but is as erect in his bearing and as active in his movements as a man of fifty. He is a delightful man to meet, and has a very cordial feeling for the profession in the States.

The Hospital of Notre Dame is also French, and has 117 beds. It occupies an old, dilapidated building, formerly used as a hotel. The atmosphere of the place, however, seemed scientific, and I must say that they made the most of their poor accommodations. Dr. Mercier, the surgeon, has a most excellent reputation.

The Hôtel Dieu and Hospital Notre Dame are connected with the medical department of the French University of Laval.

TORONTO

Toronto is a beautiful city of 225,000 inhabitants. It has wide streets, fine buildings, and a general appearance of western energy. It has three medical colleges—the University of Toronto, which is the oldest, Trinity Medical College, and the Woman's Medical School.

The Toronto General Hospital is the largest hospital in Canada, having 500 beds. It is a rambling structure of brick, not well adapted to its purpose. The main building was built in 1854. As the growth of the city compelled the addition of more beds, wings on the same general plan were erected. The medical superintendent, Dr. O'Reilly, is very energetic, and has made the best of the available space. The service is divided between three medical schools in proportion to the number of students. The lying-in and the gynecologic buildings are detached. Dr. O'Reilly said that, in their experience, wooden floors answered a better purpose than marble or tile, as flushing and scrubbing would not wholly sterilize the little cemented creases in the latter. Frequent treatment of the wood with shellac varnish thoroughly sterilizes and leaves a smooth, satisfactory finish.

Toronto has a number of very good surgeons. Mr. Cameron showed us many interesting cases in the various hospitals in the city. He is a great believer in the starvation plan of treating peritonitis resulting from appendicitis, and demonstrated some cases illustrating its value.

Dr. Primrose showed us a very instructive case of exstrophy of the bladder. In two previous cases, one by Dr. Peters and one by Mr. Cameron, the same plan had been carried out. The Maydl operation was the one adopted, and consisted of the transplantation of the ureters, with a portion of the bladder-wall, to the rectum, modified from the original in that it is done without opening the peritoneal cavity. A preliminary colostomy was performed in Mr. Cameron's case, and the rectum rendered fairly free from the colon bacillus before the ureterorectal anastomosis was made.

Dr. Peters also does an original operation for complete prolapse of the rectum. The peritoneal cavity is opened, and the dilated upper rectum and lower sigmoid are reduced in caliber by a longitudinal reef of silk sutures.

The Children's Hospital is a very handsome modern building, having a capacity of 150 beds. Three miles from the city, on an island in Lake Ontario, they have a summer hospital, and as many as possible of the children are kept there during the warm weather —usually about 100 of them. Dr. Starr, one of the attending surgeons, operated on several cases of interest, one an incision of the head of the femur for tuberculosis through a short anterior incision. This was effected largely with a sharp spoon. After iodoformization the wound was closed without drainage. For extension, in place of using adhesive plaster in the ordinary manner, which often irritates the skin, a rather close-fitting stocking with the foot cut off was applied, and on each side at the bottom a tape was attached. By applying a roller bandage over the stocking from the ankle to above the knee sufficient friction was obtained to enable extension by means of the tapes. In tuberculous abscesses Dr. Starr opens the cavity freely, evacuates the contents, and thoroughly removes the infected wall, largely by forcible sponging with gauze, and closes without drainage.

We visited St. John's Hospital for women, which has about 25 beds, and St. Michael's Hospital, which has 150 beds.

We are much indebted to Dr. Gilbert Gordon, Professor of Medicine at Trinity Medical College, Toronto, and to Mr. Cameron, for many courtesies.

ADDRESS DELIVERED TO THE GRADUATING CLASS OF THE MEDICAL DEPARTMENT OF THE MINNESOTA STATE UNIVERSITY, MAY 5, 1895 *

WILLIAM J. MAYO

MEMBERS OF THE GRADUATING CLASS: I thank you for having selected me to deliver your closing lecture. While I shall not attempt to advise you as regards your future, I wish to call your attention to the position you occupy in society, to the claim which all classes of people have upon your time and attention, and to the necessity of a broad culture upon your part to enable you to sympathize with all classes and all people in the hour of their need.

Of all the professions, the medical profession has, of necessity, always exercised a great liberality of spirit and thought toward those individuals and classes of society with whose opinions they may differ, whose actions they may condemn.

Whatever our individual beliefs may be, let us make them manifest by our acts, rather than by our words; and let us put aside all bigotry and intolerance, which would defeat the very object of our convictions by putting us out of touch with men of different views.

Let me urge you to cultivate the habit of thought and a spirit of inquiry; not to let go of the old in order to rush hurriedly after the new, but to acquire such knowledge of both the old and the new as will give you a comprehensive grasp of the whole.

Your study of exact methods and detail work, which has occupied your time until now, must be supplemented by a general knowledge of the lives and the work of people in other walks of life, in order that you can meet them as patients with a certain degree of sympathy and understanding.

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* Reprinted from the "Northwestern Lancet," May, 1895, vol. xv, pp. 221–224.

The revival of a learning which was so characteristic of the Renaissance has made manifest the growing importance of man, and, at the present time, the rights and interests of the individual can be said to be paramount to all other considerations. We observe this condition in the literature of the day, especially marked by fiction. For example, we find the modern novel to be an accurate detail of the actions and motives of individuals. Contrast the characters of DuMaurier, Hardy, Tolstoi, and others of the modern school with Hugo, Dickens, and Scott, for example, in whose works the actors serve merely to introduce classes of society, instead of individuals.

In music, to the uncultivated ear harmony seems lost in the brilliancy of execution of Wagner and Schubert. In art will be found the same fidelity to detail, while the subject itself is but a dreary bit of brown and gray.

The whole tendency of modern life is toward the amplification of purely technical work. This specialization tends to exaggerate our individual importance, thereby tending to narrow our views and check our mental expansion.

It is incumbent upon you to develop a broad culture as the only means whereby you can obtain and maintain a proper appreciation of social conditions. In the domain of medicine and surgery you have been well instructed by a corps of teachers of great ability and learning in the minute details of the phenomena of disease, and you have also been carefully taught the normal conditions as a basis of comparison with the abnormal. You have patiently examined the histologic structure of the tissues under the microscope, and in a painstaking manner have inquired into the life-history of disease-producing germs.

The rapid advance of the science of medicine has been due to a better understanding of the bacteria of disease, which knowledge enables us to attack with impunity pathologic conditions. The only technical advances are those relating to aseptic and antiseptic technic.

The surgery of traumatisms, such as fractures, dislocations, and injuries of the soft parts outside of the great cavities of the body, was well understood by our grandfathers, who were thoroughly posted in anatomy, and, as a rule, were brilliant and speedy operators.

Stories of the phenomenal quickness of the old-time surgeon are to this day the marvel of the profession. They practised the surgery of necessity, almost wholly from a clinical standpoint; but this good old anatomic and clinical work has almost passed away. The surgery of traumatism and gross pathologic lesions now forms but a small part of our surgical work. The modern practitioner can be said to be a pathologic, rather than a clinical, surgeon, and the majority of operations are performed from the standpoint of expediency—whether life cannot be prolonged and rendered more comfortable and useful; a relative indication, rather than an absolute necessity.

In the reconstruction of our art, necessitated by bacteriologic discoveries, our time has been so fully occupied by the importance of the subject and its constantly enlarging scope as new facts are brought out that we are in danger of becoming narrowed in our views. In their etiologic relations to the diseases of man vegetable bacteria may be divided in a general way into three large classes: The saprophytes, existing only in dead and dying organic matter, and which, you have been taught, are therefore not of themselves harmful in the human economy, except through their toxins. But think of their great use in the production of fermentation and decomposition, which, by breaking up useless combinations into their elements, enable new bodies to arise. This phenomenon is well shown in the religion of the Buddhist, by his veneration for all life.

The obligate germs, which must exist upon living tissue, not always to destroy; for, since they have no power to exist upon dead tissue, if they always destroyed their host, they would themselves perish. Let us look at the tubercle bacillus as a type of the obligate germ, and one in which we are all vitally interested.

From the standpoint of the individual, the tubercle bacillus is always an enemy, but for the race it is not always so, as the germ attacks the weak and sickly, especially the young, before they reproduce their kind, and, in weeding out the unhealthy by the process of the survival of the fittest, it tends to the betterment of mankind.

No one factor has played a greater part in the development of man than his resistance to disease, and it may be said that the older the race, the greater the hereditary resistance, particularly to the bad hygienic conditions which surround the action of the saprophytes, and the direct resistance to the action of the obligate germs. This is well shown in the Chinese. The superficial student of this race may think they have stood still, and this may be true as regards their mental development, but in a crowded, unhygienic existence they have developed strong powers of resistance, resulting in a survival of the fittest physically, which has made a race unexcelled today in their endurance of disease-producing conditions. Contrast this with the races of recent civilization.

The Indian question was settled not by force of arms, but by pathologic causes. The diseases of our older civilization, introduced among these people, quickly terminated their existence; smallpox, tuberculosis, and syphilis were the great factors which have rendered this race nearly extinct.

Civilization, introduced among the Sandwich Islanders, gave them Christianity, but it also gave them diseases to which they had no hereditary resistance, and in sixty years it has sent the majority of them to the hereafter they had so lately learned to prize.

The facultative germs, however, with their Jekyll and Hyde existence, are and will be the scourge of humanity. The dual power of life afforded by their ability to live as saprophytes, and under certain conditions to become attached to the human body, renders eternal vigilance the price of safety. This is shown in the results of modern sanitation in destroying the products of decomposition, and by strict quarantine preventing the introduction of disease from people less healthfully guarded.

It was a great question among earlier observers as to whether the germs themselves caused the disease, or whether the poisonous toxins developed by their presence were the exciting factor. The

Germans led in developing the germ theory. The French, with race prejudice, worked out the facts in regard to the toxins. Happily, this is now an old story, and the truth lies with both. The anthrax bacillus, by its wonderful growth, may obstruct the circulation and thus mechanically aid its ptomain in causing death, while the toxin produced by the tubercle bacillus, which closely clings to its body, causes the peculiar reactions in the tissues which are characteristic of the tuberculous process.

Germs of the same class produce different results on account of slight changes in the chemical nature of the poisonous products of their metabolism. The toxins of the staphylococcus produce tissue coagulation, but its short life-history and a toxin possessing great peptonizing power render its action far different from the diffuse inflammation of the longer lived streptococcus, whose toxins have much less power to liquefy rapidly the coagulated tissues into local collections of pus, which is characteristic of the action of the former germ.

The life-history of the larger varieties of animal parasites, such as worms, scabies, etc., has long been understood, but new discoveries in the minute organisms have been pregnant of great results, especially in that class known as the sporozoa.

An animal parasite is the undisputed cause of malaria. That it is the etiologic factor in the production of cancer and sarcoma is altogether probable, but not proved, and as much can be said as to the cause of epidemic goiter.

Remarkable similarity to the vegetable organisms is found in the action of the animal parasites and their resulting toxins. Mark the fever, chill, and sweat caused by the Plasmodium malariæ; also the occasional mania produced by the toxins of cancer and the fever of sarcoma, while the combined toxins of erysipelas and the Bacillus prodigiosus appear to exhibit curative power in the treatment of malignant disease.

The great significance of the facts connected with the germ theory was first recognized and made use of in commercial life long before its practical application to medicine and surgery was thought of. The canning of meats and vegetables after sterilization by heat is an example of its early use in the trades. Our grandmothers, in making and preserving their fruits, utilized the principles of asepsis to a marked degree.

Cold to the point of freezing inhibits the action of germs, thus producing what might be called a temporary sterilization of the putrefactive and other bacteria. This fact is largely developed in commerce by means of the system of cold storage, which enables perishable food-materials to be transported in good condition the world over.

Chemical sterilization in the preservation of foods has largely been abandoned by manufacturers, and the use of brine as an inhibitor is less common than in olden times, although salt mackerel, corned beef, and other articles are still made in decreasing quantity, being crowded out by the better varieties of fresh preparations, with a corresponding diminution of scurvy and similar disorders, which were previously so prevalent.

In the domain of medicine chemical sterilization is also being gradually discarded. The application of heat to all the material which may be brought into contact with a living surface capable of absorption, and the thorough use of cleansing agents and mechanical means for removing the superficial bacteria from the surface of the body in the exposed situation, enables asepsis to replace antisepsis to a marked degree.

It is not altogether creditable to us as a profession that commercial enterprise has so long preceded us in utilizing the principles of asepsis and antisepsis, but it illustrates our extreme conservatism as conscientious physicians whenever human life is at stake.

Nature's reaction to diseases introduced from without in a general way is characterized by three methods of defense: absorption, encapsulation, and extrusion, modified by the nature of the surrounding media and the local resistance. Absorption through phagocytosis is the same process, whether applied to a catgut ligature or to a disease-producing germ.

The encapsulation of tuberculous products is of the same nature as when applied to a silk ligature, while the attempt to surround and destroy particles of alcohol in the tissues of chronic drunkards, which on account of its diffuse character results in cirrhotic changes in the liver, kidney, or brain, a process beginning conservatively but eventually causing disastrous crippling of these important organs. Unable to absorb or encapsulate, nature engages her resources to extrude the offender, whether it be a foreign body or the sequestrum of an osteomyelitis.

One great factor of which too little account has been taken is the soil upon which the germs are grown, and the variable results which attend the action of bacteria depend to a large extent upon the condition of the individual affected; the same person may at different times exhibit a varying degree of resistance, due largely to blood changes, and effected through the agency of the germicide action of the blood-serum and the phagocytes.

A glance at this part of our subject is of interest. It may be said that the resistance to disease depends to a great extent directly upon the blood, and indirectly, but most potently, upon heredity, to which I shall have occasion to refer again.

So great has been the progress of our science and art along the line of the microörganisms that only of late has impetus been given to the investigation of diseases which depend upon the changed action of internal organs, with or without gross pathologic lesions. That we are on the threshold of great discoveries in the hematogenous diseases must be apparent to every student of the subject.

I shall discuss briefly certain changes produced in the blood by organic or functional disorders of the glandular system. The so-called ductless glands are not alone concerned, but the secreting glands also profoundly influence the blood changes so necessary to the human economy, but by their abnormal action aid in the causation of the diseases having their origin in vitiated blood states.

Of these blood conditions, leukocythemia is best understood, presenting not only an increased quantity of leukocytes and eosinophil corpuscles, but also well-defined changes of an organic nature in the spleen, and at times in the bone-marrow and lymphatic glands. The liver not only secretes gall, but has a most important function in forming urea and breaking up poisonous alkaloids and chemical compounds, such as copper and many other deleterious agents.

The pancreas not only produces its proper fluid, but in so doing eliminates certain materials from the blood, and if its work is improperly done, pancreatic diabetes may be one result. The thyroid gland is of great interest at present on account of the new knowledge in regard to its function, and it is the probable seat of the metamorphosis of mucinoid compounds, and undoubtedly breaks up some material in the blood which otherwise would act as a nerve poison, as seen in the occasional production of tetany after thyroidectomy. The induction of myxedema or thyroid cachexia by the removal of the thyroid and the resulting accumulation of the mucoid material in the body is also a well-marked example of its influence on the blood, while congenital absence of the thyroid causes cretinism.

The opposite condition of enlarged thyroid and excessive function is seen in Basedow's disease or exophthalmic goiter, which is more common in women, while myxedema is relatively more frequent in men.

New knowledge is also being developed in regard to the pituitary gland, which in low types of the vertebrates has a most important function, standing, as it does, in an opening just above the pharynx, and acting as a strainer to the entrance of fluids into the cerebrospinal canal.

That this gland has largely to do with the growth of the human organism now seems assured. Increased size and activity of this body are found in that rare and curious disease known as acromegalia, or local giantism, while enlargement of this gland is so constantly found in giants as to lead to the presumption that giantism is a disease due to pituitary hypertrophy, and possibly little people are due to the opposite condition of the hypothesis.

The suprarenal bodies undoubtedly have some function in removing from the blood certain noxious materials, and even the kidney plays an important part besides the excretion of urine.

To sum up, it may be said that all the glands, both duct and ductless, have a far-reaching effect on the body, exercised through the blood, and slight variation in function or size produces changes of an extraordinary character in the affected individual. Striking similarity to the curative value of the toxins of the microörganisms is shown in the thyroid feeding so necessary in myxedema, and also in the therapeutic value of bone-marrow in the treatment of leukocythemia and anemia.

It is possible that all the internal organs may contain specific organic chemical products, which can be obtained from the lower animals for therapeutic purposes.

Before closing I wish to refer again to heredity as affecting the soil. The hereditary predisposition of an individual to tuberculosis, insanity, and the like is so generally understood as to need no comment, but we do not often stop to think that atavistic defects, such as harelip and other evidence of lack of development, may, and often do, take the form of mental freaks, in which the individual may develop the moral or mental condition of an early ancestor. The idea, for example, being that certain criminals are born with a lack of moral development, which is found only in savage states of society, and that in such cases their criminality should be considered a disease, and not a crime.

Such variations from the normal hereditary standard take the name of degeneracy, and certain peculiar marks are found in this class of individuals with sufficient frequency to be called the stigmata or marks of degeneracy. This merely suggests to you the unthought-of and far-reaching effects of heredity, not only in its normal condition, but also in its variations, which occur so frequently as to deserve consideration at your hands as scientific men and women.

It is customary to give some practical advice at the close of the lecture season, but I fear that my age and limited experience do not qualify me for the task. I doubt not that you have already carefully observed the kind and courteous treatment of patients which characterizes your various professors, and it is unnecessary for me to say that a conscientious interest in the welfare of those who intrust themselves to your care will bring its own reward. Let me call your attention to the value of the experience of the older practitioner in the community in which you will work, and while you may be more modern in your methods, you will soon recognize the necessity of practical knowledge.

I should advise you, above all things, to cultivate your local medical societies for the purpose of maintaining those fraternal feelings of fellowship and exchange of ideas which underlie the successful practice of scientific medicine. Show me the community where the regular profession quarrel among themselves, and I will show you a place where unscientific medicine and open quackery flourish.

You must also keep up in your scientific work, and if each of you will produce one or two papers each year on a medical subject, or report some case interesting to you and to others, I can assure you that its value in mental training cannot be overestimated.

Above all things, let me urge upon you the absolute necessity of careful examinations for the purpose of diagnosis. My own experience has been that the public will forgive you an error in treatment more readily than one in diagnosis, and I fully believe that more than one-half of the failures in diagnosis are due to hasty or unmethodic examinations. Say to yourselves that you will not jump at a conclusion, but in each instance will make a thorough and painstaking physical examination, free from prejudice, and your success is assured. Do this in every case. The mental effect on the patient is good, the practical knowledge to yourself is better, and if you avail yourselves of all the means of physical diagnosis and repeated examinations, the number of unsolved cases will be surprisingly small. In conclusion, let me congratulate you upon your entrance to a great and noble profession, and that you have entered the profession through the portals of the University of Minnesota should always be a source of pride and satisfaction.

THE CLINICAL NEEDS OF THE MEDICAL COLLEGE *

WILLIAM J. MAYO

Because of the lateness of the hour, I shall not take up in detail the points I had intended to present to you. I cannot, however, refrain from referring with pride to the address which has been made this evening by Dr. Beard. I am proud to belong to a profession with such a history, and I am proud to know that the faculty of the University of Minnesota Medical Department has been able to produce a man that could give us such a history of the past as Dr. Beard has given us tonight.

I am the son of a physician, and, living in the State, I was acquainted, even as a boy, with many of the facts that Dr. Beard has brought out so eloquently. I want to call your attention to the fact that in those early days we had men who were inspiring. I should be glad to see one in particular of those men present tonight, Dr. Charles A. Wheaton, who is, unfortunately, not able to be here.

In the early days medical education in this State was essentially clinical. You will note that each of the speakers told us what he was able to give his students. Today we have a different stage, and at the present time the laboratory methods have gone beyond the clinical features of teaching. There are many reasons why this is true. We saw among the pictures exhibited upon the screen tonight the college, for instance, over in St. Paul, and the one in Minneapolis, and we smiled to see how small and inadequate those buildings were. Yet the classes taught there and the numbers that were graduated each year were not greatly different from

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* Reprinted from "Unification of Medical Teaching in Minnesota."

those which we are now dealing with in the Medical Department of the State University. Then, where lies the difference between those old colleges which have proved so inadequate and the colleges we find today, which are so expensive to maintain? It is in truth today that we have scientific knowledge and scientific truths which we did not have then. In those early times we had antitoxin, we had vaccine, but, comparatively speaking, we had very little. As time has gone on, and within the memory of us who are forty years or more, we have received new facts, new and important truths, which have proved of such great benefit to humanity that the medical profession has been placed easily in the lead of all the learned professions. Governor Lind has said that we have made good. We have been able not only to make good, but to make great gifts, collectively, to society, to the State, and to the nation, and by these gifts have added at least ten years to human life. Therefore, may we not face our Board of Regents and ask for greater things, because, as Governor Lind has said, we *have* made good?

Take, for example, the control and practical extinction of yellow fever, which cost this country $16,000,000 for quarantine, to say nothing of the sanitary campaign through the South, and the final cost of the war we had with Spain over Cuba, largely induced by the menace of this Cuban scourge. Consider the work done in tuberculosis, in typhoid fever, in all these different things which have been gifts of the medical profession to this country and to the world. In consideration of these facts, is not the Board of Regents justified in doing what it has done today in making generous provision for a class of society that has been able to do much for the State and the nation as a whole?

We must now be able to extend these gifts from individual to individual. To do this we must not only teach our students these things thoroughly, theoretically, but we must enable them to see them face to face, and this can be done only by establishing a clinical hospital at the university.

I want to call your attention to the fact that the Board of Regents has been generous and most sympathetic, and that if we leave this matter secure in their hands, within a few years we shall have a clinical hospital equal to any that any medical institution in the country can show.

I want to refer to what these two colleges did for the University of Minnesota when they put aside their own financial obligations or assumed them, and turned these two colleges over to the State. Today we have, in this medical department, one of the first seven schools in the country. It is because of the generous act of those men that we did not begin at the bottom. I think we cannot be grateful enough to them for what they have done.

THE MEDICAL PROFESSION AND THE ISSUES WHICH CONFRONT IT *

WILLIAM J. MAYO

The American Medical Association begins its fifty-seventh annual session under the most auspicious circumstances. After an interval of forty-one years it again meets in Boston, the guest of this great commonwealth, which has ably upheld the highest medical traditions since the founding of New England.

Another cause of felicitation: the sectional differences in New York have been overcome and the Empire State, for the first time in twenty-five years, presents a unified delegation.

The House of Delegates of the American Medical Association (which technically is the American Medical Association) represents directly about 55,000, and indirectly the 120,000 regular practitioners of medicine in the United States. The official organ, "The Journal," reaches each week over 43,000 subscribers, and, under the able editorship of Dr. George H. Simmons, has become the leading professional magazine in the world.

The medical profession is to be congratulated on these evidences of a useful organization, but much remains to be done. In his individual capacity the medical man has not been found wanting. Go where you will in civilized lands, you will find the physician self-sacrificing, patient, and charitable, upholding the honor and dignity of his noble calling. Collectively, medical men do not have the influence which we might expect, and without which great movements for the welfare of humanity cannot be carried on. A lack of unity has prevented a realization of our hopes, and if we

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* President's address at the Fifty-Seventh Annual Session of the American Medical Association at Boston, June 5–8, 1906. Reprinted from the "Jour. Amer. Med. Assoc.," June 9, 1906.

are to gain and maintain the preëminent position to which we are entitled, we must unite for the common good.

The present organization of the American Medical Association is but a beginning: we must further the interests of this body unselfishly, not for ourselves alone, but that we may better fulfil our sacred obligations to mankind. The people must be educated up to a point where they can understand the broad humanitarianism of modern medicine. Society appreciates the saving of a sick person's life by the skilled physician, but fails to see the priceless gifts to the human race made by preventive medicine and sanitary science. It views everything in detail and misses the perspective. We have failed to secure the support of the mass of the people to much-needed sanitary reforms, because we have appealed to them as one individual to another without the weight of an authoritative organization.

That the people are ignorant of medical affairs is due to bad education rather than prejudice. They are more than two decades behind advanced medical thought; it is our duty to keep them better informed. The theory of medicine did not contain the essential principles of a science until within the last quarter of a century. Originally a part of priestcraft, the profession had its beginnings in a time of mysticism and superstition. Anatomy, gross pathology, and chemistry were among the early foundation stones which made progress possible. Clinical treatment was based on a very few specific remedies, and a considerable number of drugs of proved value in the cure or alleviation of disease. But, lacking a sound theory of causation, the results were not much better in the average self-limited malady than those claimed by the various "systems" based on the giving of inert or useless remedies, which, like the incantation of the Indian medicine-man, kept the patient and friends interested until cure came about through natural processes. The public found that the large majority of sick persons got well under any, all, or no treatment, and, not rightly understanding the reason, have never been able to comprehend why one method or form of treatment, as long as it apparently yielded about the same average of results, was not so good as another.

The germ theory promulgated by Pasteur, and given surgical significance by Lister, strengthened our foundation by adding to it the long-sought-for causation of the majority of diseases, and this, with the aid of experimental research, has led the practice of medicine out of the wilderness and established it as one of the exact sciences.

New and fundamental truths have followed each other so rapidly that we have scarcely been able to digest them, and much less can we expect the public to have kept pace. The layman's view is that of twenty-five years ago. He accepts with avidity new dogmas and "pathys," based on theories incredibly foolish in the light of modern investigation, and we have allowed him to become fixed in these beliefs. We have permitted the public to be educated by "patent-medicine" advertisements and the voluble charlatanism of the commercially interested. In return we are classed with these schemers, and efforts for the general good are believed to be selfishly inspired.

The Utopianism of our profession is too idealistic for ready comprehension in this commercial age. The time has come for the public to be taken into our confidence; if we wish better results, we must enlighten the people, for with them lies the final word.

The Profession and the Public

General sanitary matters of the greatest importance are becoming understood through medical influences. The public has been and is being educated in regard to the "great white plague," tuberculosis, and statistics are beginning to show the effect of this diffusion of knowledge. In Massachusetts and some other States a committee has been appointed in each district to promulgate measures for the relief and control of tuberculosis. This should be imitated in every State in the Union.

We can already see the good which has resulted from investigating the habits of mosquitos, and especially the necessity for the quarantine of patients afflicted with yellow fever and malaria.

Society must be taught the early symptoms of cancer, the greatest foe of humanity, that its manifestations may be recognized while in the curable period. A propaganda of this kind, inaugurated by the profession of Germany, has borne fruit.

The typhoid fever crime of cities through polluted water-supply is not the least of the many branches of popular education. There is no reason why a man who has become infected with typhoid from a city's neglect should not sue for damages, as he would for personal injury sustained from falling through a defective sidewalk. Unavoidable sickness is bad enough, but when we stop to consider that the life of the individual is worth $5000 to the State, and that those who recover undergo great disability and expense, the continuance of unsanitary conditions is criminal. The experience of Vienna, which was converted from a typhoid center to one of freedom from such outbreaks by bringing in a pure water-supply, has now been repeated over and over again in every civilized land. Yet hundreds of deaths from this preventable source yearly attest that the lesson has not yet been thoroughly learned.

How can the work of education be best continued? The answer, as shown by our very efficient chairman of the Committee on Organization, Dr. J. N. McCormack, is through the local society. Occasional meetings to which the public shall be invited must be devoted to questions of general interest, and the proceedings published in the local newspapers. The county society must become the unit, and the allied professions of pharmacy and dentistry urged to attend and take part in the deliberations.

To the "Ladies' Home Journal" and "Collier's Weekly" the public owes the successful crusade against poisonous substances and intoxicating beverages which are sold under the guise of "patent medicines," patent only in the sense that the name is copyrighted: the constituents can be changed at any time and in any way.

Do you think that our American mothers will continue to give "Kopp's Baby's Friend" and "Mother Winslow's Soothing Syrup" to their babes when they find that these mixtures contain opium, and that, instead of securing rest, the little ones are narcotized and that many deaths are directly attributable to this cause?

Will the American people continue to use Bromo-Seltzer and similar dangerous preparations to an extent which causes them to exhibit blueness of the skin surfaces from poisonous coal-tar products, or become victims of drug habits from cocain catarrh cures when they discover the harmful and dangerous character of these agents?

Will our prominent people, statesmen, politicians, ministers, and women of note continue to allow their photographs over signed testimonials to be published, telling their fellow-citizens how much better they have felt after taking Peruna, Warner's Safe Cure, and the various nervines and tonics, when they find that most of these preparations depend on alcohol for the stimulating effects which they describe? The success of most "patent medicines" depends on the fact that they contain drugs and stimulants which create a craving and must be repeated. Once get the public conscience awakened, and we will have a demand that every "patent medicine," before being sold, shall have its exact component parts printed on its label, and its claims to cure verified by scientific investigation. The action of the Post-office Department in denying the use of the mail service to some of the worst offenders against common decency is to be commended.

PUBLIC HEALTH LEGISLATION

One of the few misfortunes of the individual freedom afforded by a republican form of government is that it enables the most ignorant man, through prejudice, to interfere with and delay needed legislation, with the result that, by the time the law can be passed, the immediate object to be obtained has often disappeared.

In Germany compulsory vaccination has practically caused smallpox to disappear from the army and country, a person properly protected being immune. In the State of Minnesota inability to inforce vaccination in the late smallpox epidemic permitted, from a few sources, 27,876 persons to become infected with this disorder—all due to a small but vociferous band of antivaccination agitators.

Contagious disease in any place is not a matter of local or State interest alone, as the ease and freedom of transportation render local control impracticable and properly place it in the hands of the general government.

The keenness with which the American people are watching the affairs at Panama argues well for the future. The communication of Dr. Charles A. L. Reed awakened public interest. His portrayal of red tape and obstruction to sanitation in the Canal Zone has resulted in obtaining for that most able army medical officer, Colonel Gorgas, power to carry out the necessary reforms, and has made the Canal Zone the most sanitary place in Latin America.

Compare our record in the Spanish-American War with that of the Japanese in the war with Russia. We had 14 deaths from disease to 1 from wounds, and more than 95 per cent. due to disregard of the simplest problems in sanitation—therefore, unnecessary and avoidable. In the Japanese army there were 4 deaths from wounds to 1 from disease—a difference of 56 to 1. This was not due to the fact that the Japanese had superior knowledge, but that their medical officers were thoroughly organized and in sanitary matters were supreme. The knowledge which they used was obtained in western institutions and was the product of the Occidental, not the Oriental, civilization.

The army and navy medical departments have worked intelligently against overwhelming odds. Their individual members have international reputations honestly achieved. Their schools for the special training of men are in the highest degree efficient and deserving of every praise; but the departments have been so small as to be unable to act, even as nuclei, about which in time of war competent forces could be gathered and the militia of our country enter into conflict fearfully handicapped. The indications, however, are that these matters will now be rectified, and if so, it will guarantee to the patriotic American that should he again be called on to serve his country, his enemies would be in front, and that he will not be destroyed through neglect of sanitary laws.

The United States Public Health and Marine-Hospital Service has been and is doing splendid work in sanitation. Its skilled investigators have revolutionized quarantine measures and have placed preventive medicine on a solid basis. Their powers should be extended so that such unnecessary outbreaks as occurred in New Orleans shall not be repeated. They should be given control of national quarantine in all its phases.

Medical Education, State Licensure, and Reciprocity

What are needed are a higher standard of requirements and more and better supervision of professional schools. The Council on Medical Education is working hard, and is now in a position not only to show what should be done, but to initiate needed reforms. No more important work has ever been taken up by the profession. At the present time medical education is uncontrolled, and each State has its own standard of requirements. We cannot rid ourselves of dogmas and "pathys" until we can secure a universal primary law as to the minimum amount of knowledge on fundamental branches. To accomplish this the American Medical Association must coöperate with and encourage medical colleges to do better work. The profession owes it to itself to investigate in some manner what the schools are actually doing, and to make it known whether or not they fulfil their obligations to the student. No well-conducted college could object to such reasonable supervision.

Another question of great importance is that of reciprocity in medical license. The conditions now are well-nigh intolerable, and restrain the individual freedom guaranteed by the Constitution. The boundaries between States are imaginary lines; yet a physician on one side of a border cannot relieve human suffering on the opposite side without becoming amenable to the law or subjecting himself to vexatious examinations which he has already successfully passed in his own State. This must be met, and speedily, by agreement between examining boards as to the minimum of requirements. After all, this is but a part of the educational problem. If we could solve this, licensing boards could at once adopt more uniform examinations and reciprocity.

RELATIONS TO INSURANCE COMPANIES, CORPORATIONS, ETC.

We come now to consider some abuses from which the physician suffers. It is a matter of professional pride that, in the general condemnation of the life-insurance companies, although every other part of the control has been shown to be corrupt, no breath of scandal has touched the medical department. Yet the local examiner has the most cause of all to be dissatisfied. The New York Life, some years ago, cut the fee for examination 40 per cent., apparently not as a matter of economy, for at that time the most corrupt practices existed, but rather to enable the agent more easily to pass "new business" at any cost. This action has lately been imitated by the Equitable and some others, and has resulted in forcing the resignation of many of their best examiners. The general officers have taken great credit on themselves for voluntarily reducing their salaries 20 per cent. It is a rank injustice that the one body of men who have emerged clean from the insurance scandals should suffer the most for the crimes of others. A thorough medical examination to prevent fraud by the admission of unsafe risks is essential. With few exceptions the line companies pay a fair fee, and less should not be accepted. The casualty companies, such as the Maryland, are the worst offenders, and some concerted action should be taken to compel them to mend their evil ways.

Lodge practice is another scheme by which officers of an association draw salaries ostensibly to give medical services at a figure below the possible point at which a professional man can live and continue his education. The people are badly served, as competent physicians cannot be secured to do the work, and the whole scheme is properly condemned by the various medical associations all over the country.

Public service corporations abuse hospital privileges in a way that is no more or less than an open scandal. In Pittsburgh the steel companies pay $1.00 a day for the care of their injured men at the hospitals, and for the class of patients under discussion this cannot be provided for less than $1.60 a day. The companies pay the surgeons at the hospitals absolutely nothing for their services to its injured, which amount to thousands of dollars a year. The same condition exists with many of the large railroad and street-car companies and other public corporations.

Hospital abuse through the neglect and indifference of the trustees by patients who are able to pay is prevalent, and thereby the profession is robbed of just returns for labor, and the funds of charitable persons misused to an extent which is almost beyond belief. All hospitals should have competent individuals whose business it is to see that no one secures free treatment who is able to pay.

Some great hospitals go still further and receive any patient, rich or poor; allow him to have a suite of rooms and bath, and several nurses if he can pay for the same; but will not allow him, even if he is willing to do so, to pay the surgeon who operates on or the medical man who takes care of him. If the patient is disposed to be more just than the trustees of the hospital, he can do so only by giving a gratuity at Christmas, as would be done with a servant. Such indignity should be resented by every right-feeling man.

It is a misfortune that the large majority of hospitals have no physicians among their directors. Hospital management is often extravagant and wasteful, due to official influence in furnishing comfortable berths for incompetent relatives or unfortunate friends in some salaried executive position.

Fortunately, the list of grievances is not large, and I believe that they can be harmoniously adjusted if taken up with the proper authorities in a conciliatory spirit. Our first object must be to see that no poor person shall be subjected to the slightest inconvenience or annoyance, and that every worthy charity shall have our united support; but we must look to it that the charitable practitioner's time, knowledge, and skill shall not be misused.

The Practice of Medicine as a Business

It is a hard matter to adjust the financial side of the practice of medicine; that doctors are poor collectors and bad investors is a notorious fact, and makes them the easy prey of the various investment "gold bricks." A physician owes it to himself, to his family, to his profession, and especially to the community at large, to manage his finances well. Otherwise he cannot pursue his studies and give to the sick his best efforts, which they have a right to expect and demand. No sensible man enters on a medical career with a view of making money. I have never known a physician who has become rich solely from this source, and it is better so, for beyond that reasonable competence which leaves him free to pursue his life-work, the care of money interferes with the highest aims of the true physician, and few who have been burdened with wealth have reached their ideal in a calling which makes no distinction between the rich and the poor.

One of the demoralizing tendencies in this commercial age is the money standard of success. Physicians are not called or chosen: accident or environment brings about their choice of profession. While professional life broadens the mental horizon and increases sympathy, it cannot change man's nature, and men who are unfair in business affairs are to be found in our midst.

The one crying evil, which, fortunately, is not wide-spread, is the giving of commissions—in other words, the selling of the confidence which the patient has in his practitioner—to some specialist who will divide the fee in return for reference of the case. The one secretly takes money from the patient without his consent, and the other, in order to complete the bargain, charges more than he should. This is equally harmful to the one who receives and to the one who gives. Such matters cannot be kept secret, and I have personal knowledge of men of good attainments and remunerative practice who have been ruined through losing the confidence of communities by this pernicious traffic. Some attempts have been made to justify it, but the very fact that it is secret shows that both parties are ashamed to have it known, and is an acknowledgment of its moral obliquity.

Our relations with the allied profession of pharmacy are not on a footing as ethical as they were twenty years ago. Then the druggist was the faithful friend of the physician. Today, in putting up from 50 to 60 per cent. of the prescriptions sent to him, the educated pharmacist cannot use his skill as a chemist, but simply acts as a distributor of copyrighted preparations which the physician calls for a few times, then takes up with something new, and leaves the shelves of the druggist filled with the unused remnants.

Many physicians compound their own prescriptions, to the detriment of the pharmacist. The proprietary medicine people have managed this very cleverly; to the medical profession they are continuously calling out that the druggist is "substituting"; with one hand they have given the physician remedies to dispense himself, and with the other furnished the druggist with "patent medicines" with which to compete with the physician, and these two natural allies have drifted apart. The average pharmacist cannot live on physicians' prescriptions alone, but he should be treated justly, and both physician and druggist would profit by mutual concessions, to the great benefit of the public.

The higher grade of pharmaceutic houses already see the danger to honest pharmacy in the forced promotion of "ethical" and fake nostrums under catchy names, and it is to be hoped, in the future, will confine themselves to the open compounding of legitimate preparations—and these and these only should be found on the advertising pages of reputable medical journals.

Medical Progress

Graduation from a college is merely a commencement of a life-study of medicine. Therefore, young men without special training under competent teachers should not be encouraged in wanton assaults on major surgical diseases unless justified by necessity. The future will demand schools for advanced training for those who desire to do special work.

The recent graduate in medicine should begin in his county society by contributions to the newer methods which will be interesting to the older men. This should be his kindergarten; from there he will carry his papers to the district meetings; and at the end of five years he will be competent to bring useful material to the State society, and later to the sections of the American Medical Association.

In the practice of medicine the student days are never over. There is so much to be learned that a long and industrious life leaves one with the feeling that he is but a beginner. The most important habit a young physician can form is the "daily study habit." Let him put in even one hour a day reading journals and books of reference, and much can be accomplished. He should keep an account of the time, and if something interferes for a day, he should charge himself up with it. A two weeks' vacation means fourteen hours to be made up. Most men can do more, and no man has a right to do less, no matter how busy he may be. The leaders in our profession make a daily average of five or six times this amount of study the year round, in addition to the demands of an active practice.

The practitioner must make frequent trips away for the purpose of observation. In no other way can he avoid the rut of self-satisfied content, which checks advancement and limits usefulness. No amount of diligence as a student can take the place of personal contact with men in the same line of work.

What are the rewards of so laborious a life? They cannot be measured, because there is no standard of comparison. To realize that one has devoted himself to the most holy of all callings, that without thought of reward he has alleviated the sufferings of the sick and added to the length and usefulness of human life, is a source of satisfaction money cannot buy. I know many a man, grown gray in the profession, with little of a tangible nature to show as a result of his work, but who is not only contented with his lot, but proud to have served in the ranks, and who looks back on a life of privation and hardship for the benefit of humanity as a privilege which he is thankful has been vouchsafed him.

Let us continue to strive as individuals for the honor and dignity of our profession. In this we but follow out the aims and ideals of those who have gone before and prepared the way. But the great movements of the future cannot be brought about by individual action. They must be initiated and controlled by united effort, and in no other way can the epoch-making truths of preventive medicine be made to bear fruit. Unity is the spirit of the times; it marks the difference between the old and the new.

The vital need of the medical profession is a harmonious organization—an organization that will encourage right thinking and good usage among ourselves, help to secure needed medical reforms, compel redress of grievances, and promote and encourage the highest interests of its individual members; in this lies the future usefulness of our profession as a whole.

REPORTS OF CASES*

W. W. AND WILLIAM J. MAYO

We inclose a report of a few cases of general interest which have occurred in our practice during the past year.

The catgut ligature, drainage-tube, and absorbent cotton have given great satisfaction in the treatment of our surgical cases. Two out of three cases of amputation of the breast for scirrhus were healed with but a single dressing on the eighth day, when the drainage-tube was removed. In the third case silk sutures were used.

In amputations we unite the components of the flaps over the bones in separate layers with catgut. In one case, a man of seventy-five years, amputation in the middle third of forearm, union took place in three weeks.

Group 1

In three cases of strangulated hernia two necessitated the forming of fecal fistula:

Case I.—G. C., male, aged seventy-two years. He had been treated by homeopaths for eleven days, and was found in a condition hardly to warrant an operation. At his request the hernia was liberated, the gut being found in a gangrenous condition; it was opened and sutured to the edges of the incision. The patient rallied surprisingly; in ten days he was able to be around, feces passing freely by the fistula, but during the fourth week he failed and died of exhaustion.

Case II.—Mrs. A. J., aged sixty-two years. Strangulated femoral hernia. A physician was not called until the seventh day. The intestine, a loop of the colon, found to be gangrenous. Towels wrung out of hot water were applied to it for some time, but failed to restore the circulation. The gut was liberated, incised, and sutured to the incision, gas and feces passing at once, with great relief. At this writing ten days have elapsed with very satisfactory improvement.

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* Reprinted from the "Trans. Minnesota State Medical Society," 1885, pp. 43–51.

Case III.—In a case, probably of cancerous obstruction in the transverse colon, in which the patient, a man over fifty years of age, had been sustained by nutritive enemata for four weeks and was nearly exhausted, a right lumbar colotomy with fecal fistula was made, followed by relief, food being borne well and feces passing through the opening; the patient, however, was too much exhausted, and died within a week. In a like case we would operate early.

Group 2

Case I.—*Ovarian Tumor. Operation: Recovery.*—Mrs. J. W., aged thirty-three years, mother of two children. Examined January 11, 1882. She complained of swelling in the left side, which a careful physical examination proved to be a cystic degeneration of the ovary of small size. About this time she became pregnant, and the following May aborted. This resulted in a pelvic cellulitis, from the effects of which she recovered slowly.

The growth of the tumor was gradual. In October an operation was recommended. She would not consent to this, and as the tumor had become so large as to interfere with respiration, it was tapped, but refilled rapidly. Her general health deteriorated; she became emaciated, unable to retain nourishment, and finally, as a last resort, consented to an operation.

Operation December 14, 1882. Under chloroform anesthesia a multilocular cyst was removed, weighing 24 pounds. It had but few adhesions, the only complication being a pelvic abscess of large size between Douglas' culdesac and the rectum, the result of the cellulitis. This was opened; a large amount of pus flowed into the abdominal cavity, which was carefully sponged out and a drainage-tube inserted at the lower angle of the incision, which was sutured with silk. The operation lasted about one hour, and was followed by considerable shock. On the fourth day the glass drainage-tube was removed, but the patient did not do well, gaining very slowly for several weeks, until in January, 1883, there was a spontaneous discharge of pus from the rectum, probably from the refilling of the abscess cavity; after this she convalesced speedily.

Case II.—*Ovarian Tumor. Operation. Death.*—Miss H. L., aged thirty-eight years, was referred to me May 1, 1884, for removal of an ovarian cyst which had made its appearance in September, 1882. The condition had been diagnosed by her attending physicians, but an operation was refused. During the following summer she was tapped for temporary relief. After this she passed into the hands of an irregular practitioner, who proposed to cure her by baths, electricity, and later by frequent tappings, removing small quantities of fluid; a result of this method was an attack of diffuse peritonitis, from which she nearly died.

Operation May 21, 1884. No separation in the line of the incision was possible between the parietal and investing layers of the peritoneum, the parts being completely agglutinated by the freshly formed adhesions. The tumor was polycystic, the largest cysts being emptied by the cannula, their walls carefully separated from the abdominal parietes; the very extensive adhesions to the intestines were separated and ligated with fine silk. Getting now to the base of the tumor, it was found so firmly adherent to the surrounding parts as to render separation impossible. Accordingly, it was enucleated from the investing peritoneum, this drawn together and ligated with stout silk. The pedicle was very thin, the tumor evidently deriving much nutrition from the adhesions. The abdominal cavity was carefully cleansed of the fluids with which it had been flooded; a glass drainage-tube inserted at the lower angle, and the wound closed with silk. After the operation the patient rallied slowly. The drainage-tube was removed on the fifth day, and she gained steadily until the tenth day; at this time diarrhea set in, followed by collapse, and death occurred May 31, 1884.

Case III.—*Traumatic Stricture; Perineal Section.*—J. N., male, aged thirty-seven years. On November 2, 1884, he fell from a scaffolding, striking astride a swinging door, and suffered from retention of urine. Ineffectual attempts were made by his physician to pass catheters through the injured urethra; to relieve the retention a trocar was plunged into the bladder above the pubes, and a cannula allowed to remain, through which the urine passed for twenty days, while repeated efforts were made to pass instruments. Failing in this, and the patient becoming exhausted with cystitis from insufficient drainage, I was sent for to make a perineal section. I found the injury to be a laceration of the urethra for about three inches, including the membranous and prostatic portions. Passing a large steel sound into the urethra as far as the seat of injury, and with a finger in the rectum, I made an incision in the median line from the tip of the sound through the perineum toward the anus, and carefully dissected my way through the disorganized tissues, hoping to find the urethra. Failing in this, I filled the bladder by the cannula with water, and, making pressure upon it with the idea of causing some of the fluid to flow into the wound, furnishing a guide. But this proving unsuccessful, I withdrew the cannula from its insertion into the superior bladder-wall, and in its place pushed a small steel sound, catching its tip in the bladder neck; it was firmly held by an assistant. With this additional guide I completed the cystotomy with ease, cutting from the tip of one sound to the tip of the other, and the sound in the urethra was pushed on into the bladder; the urethra was placed in as good a condition as its lacerations would permit; the wound was packed with absorbent cotton. The after-treatment was carefully managed by Drs. Ransom and Porter, and at last accounts he was entirely recovered, urine passing naturally.

Group 3

Case IV.—*Lingual Epithelioma.*—M. M., female, aged fifty years. Consulted me March 22, 1884, in regard to a growth of the tongue which appeared the previous fall, and was supposed to be due to the irritation of a broken tooth. It was a typical epithelioma of the anterior third of the tongue, involving the floor of the mouth. March 23d, assisted by W. W. Mayo and Ida Clark, I removed the diseased portion, the patient being in a reclining position and under the influence of chloroform. I passed a stout cord through the tongue behind the growth, and drawing it forward, cut the cancerous portion away with dulled scissors, cauterizing the stump with the hot iron, and thoroughly scraping the floor of the mouth with a sharp scoop. From the extent of the disease and its infiltration into the surrounding tissue an unfavorable prognosis was given, and after several months of comparative comfort the growth reappeared and the patient rapidly succumbed.

Case V.—*Alveolar Sarcoma—Removal.*—M. M., female, aged twelve years. In October, 1884, I was consulted in regard to a growth of the gum on the left upper jaw, between the second bicuspid and first molar teeth, displacing the former outward. Under chloroform the tooth was drawn, the epulis cut away, and its alveolar attachments removed. In February, 1885, she returned with the growth reformed, of considerable size, involving the entire alveolar process of the left superior maxillary bone, pushing the teeth outward. On February 9, 1885, with the patient half sitting and under chloroform, the teeth were drawn, the alveolar process divided with bone forceps and wrenched, the sharp scoop and bone chisel being thoroughly applied to the remainder of the jaw. The profuse hemorrhage was checked with the actual cautery; the wound, which included the antrum, was packed with cotton and powdered subsulphate of iron. The sections of the tumor under the microscope gave the characteristic cells of myeloid sarcoma. The wound healed, and the growth has not returned.

Case VI.—*Compound Comminuted Fracture of Skull.—Escape of Brain Substance—Recovery.*—A. P., male, aged eight years, was struck by a ⅜-inch bolt of a feed-mill while in motion, above the right ear, the bolt entering to the depth of 1¼ inches, fracturing the skull, lacerating the anterior branch of the middle meningeal artery, the meninges, and frontal cerebral lobe, probably near Rolando's fissure; about a tablespoonful of brain matter escaped.

The pieces of bone were removed, the hemorrhage checked by pressure, the wound dressed with a compress, which was not removed until the fourth day. The wound healed by granulation with but little general disturbance. At this writing, two months after the accident, the boy is in perfect health, with nothing but a soft, pulsating depression to mark the injury. The after-history will be watched with interest as to its effect on his mental development.

REPORT OF CLINIC AT ST. MARY'S HOSPITAL, ROCHESTER, MINN., JANUARY 19, 1891*

WILLIAM J. AND CHARLES H. MAYO

Case I.—*Ovariotomy.*—Miss E., aged sixteen years. The tumor was first noticed two years previous, and about eight months before her first menstruation, which had continued regular since. She has been tapped five times.

The growth was multilocular. One cyst contained about a pint of pus. A very extensive adhesion to the omentum was found, and ligated in sections with catgut, the pedicle being tied with silk. The other ovary was normal and not removed. The points of interest in this case are: The age of the patient; the relation of the tumor's appearance to the time of menstruation; also that pus was found in one cyst, probably the result of infection from aspiration.

Case II.—*Amputation of Hand.*—Mr. J. E., aged sixty years. Was injured in the left hand by the tine of a pitchfork over thirty years ago. The wound resulted in necrosis and loss of most of the carpal and metacarpal bones of the hand, leaving it fixed and useless. Following a severe strain of this arm two years ago a paralysis agitans, limited to this extremity, was developed. He suffered from painful paresthesia of the hand and a tremor which was under momentary control during voluntary motion. Two weeks ago a section of the musculospiral nerve was made, with the hope that in paralyzing the extensor muscles he would obtain relief in a contracture of the flexors. Some benefit was derived, but as a tremor still existed, a section of the median and ulnar nerves was made one week later, which gave marked relief of oscillation. He still suffered with more or less tremor of the muscles of the forearm, due to the binding of the tendons in the old scars. For this reason, and the hand being practically useless, amputation was made at the lower third of the forearm. Catgut drains were used, and the flaps approximated with retention sutures over iodoform gauze rolls.

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* Reprinted from the "Northwestern Lancet," March 15, 1891.

Case III.—*Nephrotomy.*—Mrs. W., aged thirty years, was sent with a diagnosis of probable pyonephrosis. This patient has lost a brother and sister from phthisis, and has been in poor health for the past eight years herself. Has never complained of special urinary difficulty, but has noticed frequently a deposit of whitish, cheesy material in the urine after settling; has also had occasional attacks of severe pain in the region of the left kidney. She has been much worse during the past three weeks, suffering with intense pain in the left lumbar region, which is also somewhat tumefied. There is a local bronchitis in the lower part of the left lung, and a pleurisy with a small amount of effusion, which in our experience is not infrequent as a result of abscesses of either the liver or kidney. During the past twenty-four hours 18 ounces of urine were voided, depositing about 2 ounces of pus. With the patient in the semiprone position, a left oblique incision was made; the costo-iliac space was unusually short in this case. Thick pus containing cheesy flakes was found outside the capsule of the kidney, communicating with its pelvis through a small opening due to the ulceration of the tuberculous pyelitis, similar to a case operated on in this clinic four weeks ago. A large drainage-tube was inserted, and the wound dressed by the open method with moss-packs.

Case IV.—*Castration.*—Mr. P. J. D., aged thirty-four. This patient is of a tuberculous family, one brother and a sister having had operations for tuberculous adenitis. Five years ago he was under treatment for Pott's disease of the lower dorsal region with partial paralysis of the lower extremities. By mechanical support he was cured of this paralysis and the spinal disease arrested, leaving some deformity. He now presents himself with tuberculous epididymitis. The history of this case exemplifies the so-called scrofulous type of tuberculosis, showing a lack of resistance in bones and glands as distinct from those evidenced by tuberculosis of the serous surfaces and lungs. Less than a year ago he noticed an enlargement of one testicle, soon followed in the other. A sinus formed, leading to the right testicle. The progress of the disease was not painful. Both testicles, with all inflammatory deposits, were removed, and the wound drained with catgut strands.

Case V.—*Amputation, Metatarsal.*—Mr. J. D., aged fifty-nine years. Has had a bunion for years over the fifth metatarsal phalangeal joint. A sinus had opened, communicating with the joint, through which necrosed bone could be felt. This man is an alcoholic, and as such cases usually take an anesthetic badly, we gave him a hypodermic of morphin, ¼ grain, before the administration of the ether. The distal portion of the fifth metatarsal bone with its phalangeal extremity was removed, the tissues being infiltrated with pus. The wound was packed with iodoform gauze and loose sutures of silk inserted and covered with a moist dressing, this pack to be removed the third day, and the wound approximated by drawing the sutures tight. In the large majority of such infected cases we have secured aseptic healing with this treatment.

CLINICAL REPORT

Complete Section of Vas Deferens*

WILLIAM J. MAYO

Complete Section of the Vas Deferens; End-to-end Union by a Simple Method, which Might be Applied to a Divided Ureter.—M. E. N., male, aged twenty-two, was admitted to St. Mary's Hospital July 27, 1894, with the following history: Patient had suffered for three years from a large varicocele of the left side. Six weeks before admission he received a severe kick, in which the tissues of the cord were badly injured.

There was a painful enlargement of considerable size, involving the whole of the structure of the cord, separated by a space of an inch from the testicle below, which was somewhat enlarged.

Operation July 30, 1894. Free incision revealed a mass of injured veins with an acute angle in the vas deferens, which had been lacerated and was occluded. Complete resection of the cord was made, including 1½ inches of the vas deferens. The cord, exclusive of the vas deferens, was treated by ligation of the stumps with catgut and knotting the ligatures together, thus raising the testicle to a higher level. A round intestine needle was then threaded with a strand of No. 4 catgut, and pushed into the lumen of the lower end of the severed vas deferens about ¾ inch, and turned out through its wall laterally, drawing the catgut through. The needle was unthreaded and rethreaded upon the opposite end of the catgut, and this was carried up the upper end of the vas deferens ¾ inch, and turned out through its lateral wall. The two ends of the divided vas deferens were now slipped together along this internal splint like beads on a string until they met end to end. Knots were tied on the catgut at each point of emergence from the vas deferens to form a shoulder and prevent slipping with separation. The wound was closed without drainage, and healed promptly. Patient was discharged in eighteen days, with testicle in normal condition. Reëxamined one month later, and the result found perfect.

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* Reprinted from "Annals of Surgery," January, 1895.

The union of a divided vas deferens has seldom been successfully accomplished, and the conditions to be confronted are very similar to the union of a divided ureter.

The use of an absorbable internal splint like catgut, which does not completely fill its lumen and cause obstruction, has much to commend it, being simple and easy of execution, bringing the ends together without shortening, and in their normal relations.

In making the suggestion that this method might be carried out in a divided ureter, we are well aware that, due to the work of Fenger, Van Hook, Küster, and Kelly, we have several good methods of securing union of a divided ureter. The ingenious and most excellent method of Van Hook, which has the largest application, causes some shortening, and where a portion of the ureter had been removed, might be impossible. In the case reported by Howard Kelly the ureter was much dilated, and was especially suited to this method, which, under normal conditions, is not always easy to carry out. The use of catgut, after the method described for union of the vas deferens, might be of service where other methods could not be accomplished, and would not sufficiently occlude the ureter to prevent free passage downward of urine, or it could be reinforced by external suture. Even should the union be but partial and leakage take place, the experience of Fenger in leaving an incised ureter without suture to heal by granulation, and securing union without stricture, is certainly encouraging, and provision could be made for drainage, if necessary.

ACUTE SUPPURATION OF THE KNEE-JOINT*

CHARLES H. MAYO

Acute Suppuration of the Knee-Joint; Treatment by Transverse Anterior Incision, Partial Dislocation, and Dry Gauze Packing.— J. S., Bohemian, aged eight, was admitted to St. Mary's Hospital July 22, 1894, with the following history: Three and a half weeks before admission the boy was accidentally wounded in the outer and upper part of the right knee by a scythe in the hands of his father. This injury was rapidly followed by fever and chills and well-marked septic symptoms, and the thigh became very much swollen. Several abscesses in the neighborhood of the joint had been opened by the attending physician. When admitted, his condition was profoundly septic. Pulse, 140; temperature, 104° F. He was more or less delirious, and was suffering great pain. The knee was swollen, and on pressure exuded pus at the site of the original puncture. There was a huge abscess in the thigh, extending from the external condyle to the great trochanter, and one equally as large extended from the head of the tibia to the internal malleolus. In the face of such grave septicemia amputation at the thigh seemed to promise the only hope.

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* Reprinted from "Annals of Surgery," January, 1895.

July 23d: Under ether anesthesia a transverse incision was made across the anterior face of the joint, cutting the patella with a heavy knife, and opening the joint as for an excision. The tibia was partially dislocated forward, the leg was flexed on the thigh, and a thorough gauze packing of the cavity was done. The upper and lower abscess cavities were treated by free incision and gauze packing.

After-history.—The temperature and pulse fell rapidly to the normal. The wounds were treated by the dry gauze packing, and when the joint was filled with protective granulations, the bones were restored to their normal position and allowed to heal by granulation, with resulting cure in two months, the knee becoming firmly ankylosed.

Surgeons in hospital practice frequently meet with neglected cases of joint suppuration in which recovery with a movable joint is out of the question, and too frequently amputation must be resorted to as a life-saving measure.

Dividing the knee-joint cavity into spaces and treating suppuration by from 4 to 6 drainage-tubes, as recommended by Andrews and Gerster, suffice for some cases, and may be supplemented by a tube-drain through the popliteal space, as practised by Hartley and others, while Frederic S. Dennis and Roswell Park report cases successfully treated by continuous irrigation or immersion in weak antiseptic fluids, but in a considerable number of cases amputation or death results. The knee-joint cavity is a large lymph-space, and absorption is most active and general sepsis is quickly produced, while the nature of the cavity is such as to prevent thorough drainage so long as the joint surfaces are left in contact.

Free exposure by the ordinary incisions for excisions permits the thorough application of dry gauze packing and complete obliteration of the pockets.

Gastro-enterostomy by Means of the Murphy Button*

WILLIAM J. AND CHARLES H. MAYO

Gastro-enterostomy by Means of the Murphy Button, with Table of Late Cases of Anastomoses by this Method.—A. A., Norwegian, male, aged seventy, was admitted to St. Mary's Hospital August 2, 1894, with the following history: Patient had been an unusually robust man until three months before admission to the hospital. He then began to suffer from a moderate amount of gastric distress, but not of serious nature, until one month previous, when he began vomiting—at first food, later a coffee-ground material: his bowels were obstinately constipated, and emaciation was rapid from that time.

On examination patient was found to have a chronic bronchitis with considerable expectoration. There was no tumor discoverable in the region of the stomach. Irrigation of the stomach gave no information further than that the stomach was markedly dilated. The vomit consisted of food taken and partially digested blood. Examination of test-meals showed the reaction to be feebly acid. Urine contained neither albumin nor peptones.

August 4, 1894: The stomach was carefully washed out and ether administered. A transverse incision, 5 inches in length, was made, and a cancerous obstruction of the pylorus was brought into view; enlarged glands could be plainly felt behind the malignant mass, and pylorectomy, which had been contemplated, was out of the question. The jejunum was then brought up and gastro-enterostomy performed by means of the large-sized Murphy button and the incision closed. The time consumed was twenty minutes.

In spite of the fact that the stomach was supposed to be empty, vomiting took place during the anesthesia, and some of the vomit was aspirated into the bronchial tubes. The patient was removed from the table breathing badly and requiring artificial respiration for some minutes.

After-history.—Patient was nourished by rectal alimentation for three days, vomiting of grumous material took place occasionally for thirty-six hours, then ceased and did not return. After the third day he was fed by the mouth in gradually increasing quantities; his bowels acted daily, and the relief was great, until death took place two weeks later. At no time did the abdominal condition give rise to anxiety, the wound healing promptly. The bronchitis developed into a well-marked aspiration pneumonia, and death followed from this cause at the end of the second week. A postmortem examination, made by Graham, revealed the small and large bronchial tubes filled with purulent material, and pus exuded on section from numerous small abscesses.

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*Reprinted from "Annals of Surgery," January, 1895.

Abdomen.—Incision healed. Carcinoma of pylorus completely obstructing its lumen with enlarged glands in the mesentery and lesser omentum. The gastro-intestinal union was so perfect as to appear like a normal opening; on separation the line of union was firm, and but little, if any, thicker than the intestinal wall. The opening was clean cut, and the different coats seemed to unite with little intervening cicatricial tissue, and, to our surprise, the opening was much larger than the button. The button was free, and while not yet passed, was causing no obstruction, and would undoubtedly soon have been evacuated. It is possible that the fatal bronchopneumonia could have been prevented by chloroform anesthesia.

Nearly a year and one-half ago we made a cholecysto-enterostomy by means of the Murphy button in a man seventy-one years of age for relief of complete obstruction of the common duct; the patient is alive and well at the present time. The ease, rapidity, and certainty with which the anastomosis was effected in these two cases have convinced us of the practical utility of this remarkable device. Through the kindness of Dr. Murphy we append herewith a tabulated statement of anastomoses made by means of the button since the complete list published in the "Medical Record," May and June, 1894. It will be noted that in one of the fatal cases reported, where the stomach-wall slipped out of the grasp of the button and leakage took place, the smallest size button was used, which is not intended for this purpose, and is too small to grasp and hold the tissues. In addition to the list of cases published are a number which have not as yet been reported, among others 7 cases by Joseph Price, 6 of which were successful; adding these 7 cases to the table, gives a total of 44 cases in this supplementary report. It will be noted that in 5 of the 9 fatal cases the anastomoses were made for malignant disease.

TABLE OF RECENT CASES OF INTESTINAL ANASTOMOSES IN WHICH THE MURPHY BUTTON HAS BEEN USED

Cholecystduodenostomies for Cholelithiasis

No.	Date.	Publication.	Operator.	Diagnosis.	Operation.	Method.	Position.	Result.		Cause of Death.	Remarks.
								R.	D.		
1	April 17, 1894.	"Buf. Med. and Surg. Jour.," July, 1894.	Mynter.	Cholelithiasis. Enlarged gall-bladder.	Cholecystduodenostomy.	Murphy button.	S-S	1	.	..	Rapid recovery. Button passed twenty-second day. 126 gall-stones.
2	March, 1894.	Not publ'd.	Bradley.	Obstruction common duct.	Cholecystduodenostomy.	Murphy button.	"	.	1	Exhaustion seventh day.	Postmortem. Profuse hemorrhage from liver, where it had been torn during operation in freeing adhesions. Approximation perfect. Time for operation, forty minutes.
3	May, 1894.	"	"	Cholelithiasis. Dilatation of gall-bladder.	Cholecystduodenostomy.	Murphy button.	"	1	.	..	150 calculi. Button passed forty days after operation.
4	Oct. 16, 1893.	"	Ferguson.	Gall-stones.	Cholecystduodenostomy.	Murphy button.	"	1	.	..	Excellent recovery.
5	Feb. 22, 1894.	"	"		Cholecystduodenostomy.	Murphy button.	"	1	.	..	" "
6	March 23, 1894.	"	"	"	Cholecystduodenostomy.	Murphy button.	"	1	.	..	" "
7	May 16, 1894.	"	Parkhill.	"	Cholecystduodenostomy.	Murphy button.	"	1	.	..	Button passed twenty-second day. Convalescence uneventful.
8	July 26, 1894.	"	Burdick.	Cholelithiasis. Obstruction.	Cholecystduodenostomy.	Murphy button.	"	1	.	..	Button passed fourteenth day. Large calculus allowed to remain in choledochus.

TABLE OF RECENT CASES OF INTESTINAL ANASTOMOSES IN WHICH THE MURPHY BUTTON HAS BEEN USED.—(*Continued.*)

CHOLECYSTDUODENOSTOMIES FOR CHOLELITHIASIS

NO.	DATE	PUBLICATION.	OPERATOR	DIAGNOSIS.	OPERATION.	METHOD.	POSITION.	RESULT.		CAUSE OF DEATH.	REMARKS.
								R.	D.		
9	Sept., 1894.	Not publ'd.	Murphy.	Cholelithiasis. Obstruction of cystic duct.	Cholecystduodenostomy.	Murphy button.	S-S	1	.	..	Time for operation, twenty minutes. Difficulty experienced in pressing large calculus from cystic duct back into gall-bladder. Sixty calculi removed.
CHOLECYSTDUODENOSTOMIES ON MALIGNANT CASES											
1	March, 1894.	"Buf. Med. and Surg. Jour.," July, 1894.	Wiggin.	Stenosis of common duct.	Cholecystduodenostomy.	Murphy button.	S-S	.	1	Prostration on fourth day.	No peritonitis. Perfect adhesions. Multiple carcinoma of pancreas and liver.
2	Feb. 2, 1894.	Not publ'd.	King.	Carcinoma of pancreas.	Cholecystduodenostomy.	Murphy button.	"	.	1	..	No peritonitis. Cholemic hemorrhage from mucous surfaces of body.
RESECTION.—END-TO-END APPROXIMATION											
1	June 13, 1894.	Not publ'd	Limonex.	Strangulated hernia.	Resection. End-to-end anastomosis.	Murphy button.	E-E	1	.	..	Button passed eighteenth day.
2	June 21, 1894.	"	Cochems.	Strangulated hernia.	Resection. End-to-end anastomosis.	Murphy button.	"	1	.	..	Resection of 26 inches, button passed one hundred and eighty hours after operation.

3	June 15, 1894.	Not publ'd.	McCallum.	Strangulation of ileum.	Resection. End-to-end anastomosis.	Murphy button.	R-E	1	.	. .	12 inches of ileum resected.
4	April 2, 1894.	"	Newton.	Neoplasm of mesentery.	Resection. End-to-end anastomosis.	Murphy button.	"	1	.	. .	Button passed fourteenth day. (Small child.)
5	April 7, 1894.	"N. Y. Med. Jour.," September, 1894.	Dennis.	Strangulated hernia.	Resection of ileum.	Murphy button.	"	1	.	. .	Button passed twenty-two days after operation. Wound suppurated. Fecal fistula which closed on twenty-seventh day.
6	May 12, 1894.	Not publ'd.	Meyer.	Intussusception. Myosarcoma.	Resection of ileum.	Murphy button.	"	1	.	. .	Button passed eleven days after operation. Perfect recovery.
7	June 16, 1894.	"	"	In. obstruction. Intussusception. Sarcoma.	Resection of ascending colon 12 inches.	Murphy button.	"	1	.	. .	Button passed eleven days after operation. Discharged July 24, 1894. Died of marasmus August 14, 1894.
8	June 18, 1894.	"N. Y. Med. Jour.," September, 1894.	Lilienthal.	Carcinoma transverse colon.	Resection transverse colon 6 inches.	Murphy button.	"	1	.	. .	1¾ inches (in diameter) button used. Passed eighteenth day without pain.
9	Nov. 11, 1893.	(?)	Ricketts.	Carcinoma of ileum; obstruction.	Resection. End-to-end.	Murphy button.	"	.	1	Shock. 10 hrs.	Time for operation, ten minutes.
10	May 11, 1894.	Mathews, "Med. Quart.," July, 1894.	Outerbridge.	Carcinoma transverse colon.	Resection. End-to-end.	Murphy button.	"	1	.	. .	Time for operation, one hour, forty-five minutes. Several inches of transverse colon resected.

TABLE OF RECENT CASES OF INTESTINAL ANASTOMOSES IN WHICH THE MURPHY BUTTON HAS BEEN USED.—(*Continued.*)

RESECTION.—END-TO-END APPROXIMATION.

No.	Date.	Publication.	Operator.	Diagnosis.	Operation.	Method.	Position.	Result.		Cause of Death.	Remarks.
								R.	D.		
11	June 13, 1894.	Not publ'd.	Meyer.	Carcinoma of rectum.	Resection of rectum 8 inches. Kraske-Rehn.	Murphy button.	R-E	1	.	. .	Death July 22d. Gangrene of lower end of sigmoid with fecal fistula above line of union, due to tension of mesosigmoid. Button accomplished purpose admirably. Voided on eleventh day.
12	June 7, 1894.	Not publ'd.	Cobb.	Syphilitic stricture.	Anastomosis around stricture.	Murphy button.	"	1	.	. .	Died fourteen days after. Pneumonia. Anastomosis perfect.
13	Feb. 27, 1894.	"	Ferguson.	Cancer of cecum.	Extirpation of cecum 14 inches.	Murphy button.	E-S	1	.	. .	Patient died four weeks later of diarrhea. Autopsy. Perfect approximation. Opening large as button. Diphtheric colitis.
14	June 17, 1894.	"	Davis.	Penetrating wound of abdomen. Laceration of bowel.	Resection. End-to-end.	Murphy button.	E-E	.	1	Shock. 3 hrs.	Never rallied from shock of injury.
15	Aug. 31, 1894.	Not publ'd.	Beck.	Carcinoma of cecum.	Resection of cecum.	Murphy button.	L	1	.	. .	Ends of intestines sutured. Lateral anastomosis with button No. 3.
16	June 4, 1894.	"	Murphy.	Fecal fistula.	Resection. End-to-end.	Murphy button.	E-E	1	.	. .	Removed 25 inches of small intestine. Opening made by button in previous operation had dilated from 3½ up to 5 inches.

SIDE-TO-SIDE ANASTOMOSES

1	July 7, 1894.	Not publ'd.	Wiggin.	(?)	Double anastomosis.	Murphy button.	S-S	.	1	. .	Death 60 hours after operation, from obstruction by adhesions of intestine in a sharp angle at seat of operation, producing obstruction. Line of union at both places perfect and barely visible. Pressure atrophy almost complete at seat of adhesion, where adherent bowel protected line of union.
2	Aug. 16, 1894.	"	Meyer.	Fecal fistula.	Ileocolostomy.	Murphy button.	"	1	.	. .	Oblong button used in this case, which passed on tenth day without pain or difficulty.

GASTRO-ENTEROSTOMY

1	May 5, 1894.	"Med. Week," Paris, No. 38, vol. ii.	Quénu.	Epithelioma of stomach.	Gastrojejunostomy.	Murphy button.	L	1	.	. .	Time for operation, one hour, fifty-five minutes. Uneventful recovery. Up in eighteen days. Great increase in weight.
2	April 19, 1894.	Not publ'd.	Bressler.	Obstruction of pylorus.	Gastro-enterostomy.	Murphy button.	"	1	.	. .	Death four weeks later. Exhaustion. Button found at splenic flexure of colon retained by band of adhesion. No obstruction.

Table of Recent Cases of Intestinal Anastomoses in which the Murphy Button has been Used.—(*Concluded.*)

Gastro-enterostomy

No.	Date.	Publication.	Operator.	Diagnosis.	Operation.	Method.	Position.	Result.		Cause of Death.	Remarks.
								R.	D.		
3	Aug. 13, 1894.	Not publ'd.	Mayo.	Carcinoma of pylorus.	Gastro-enterostomy.	Murphy button.	S-S	1	.	..	Death fourteen days after. Bronchopneumonia. Autopsy: Perfect union. Button liberated. Opening about twice as large as button.
4	Aug. 6, 1894.	"	Meyer.	Malignant stricture of pylorus.	Gastro-enterostomy.	Murphy button.	L	1	.	..	Rapid recovery. Discharged August 25, 1894.
5	Aug. 23, 1894.	"	Meyer.	Carcinoma of pylorus.	Gastro-enterostomy.	Murphy button.	"	1	.	..	Patient still in hospital doing well (September 6, 1894).
6	April 20, 1894.	"Buf. Med. and Surg. Jour.," July, 1894.	Mynter.	Carcinoma of pylorus.	Gastro-enterostomy.	Murphy button.	"	1	.	..	Vomiting ceased. Patient left hospital in three weeks.
7	May, 1894.	*Ibid.*, July, 1894.	"	Carcinoma of pylorus.	Gastro-enterostomy.	Murphy button.	"	.	1	Exhaustion, 12 hours.	..
8	1894.	*Ibid.*, July, 1894.	"	Carcinoma of pylorus.	Gastro-enterostomy.	Murphy button.	"	.	1	..	Smallest size button used, which could not possibly grasp tissue and was never intended for that purpose. The wall of stomach slipped out of its embrace, and allowed contents to escape. A running suture is not necessary if proper size button is used. Large carcinoma of stomach.

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